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#78

the Ophthalmologist®

The Latest Landmark Literature

Tracing the advances in ophthalmology research in 2024-25

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We are excited to announce that The Ophthalmologist is now officially part of Conexiant Vision!

Home to a number of titles including Ophthalmology Management Contact Lens Spectrum and Glaucoma Physician this strategic integration brings together The Ophthalmologist's trusted expertise in ophthalmology with Conexiant Vision's cutting-edge technology and innovative vision solutions.

This partnership allows us to expand our commitment to providing comprehensive, patient-centered eye care. By combining advanced diagnostic tools, treatments, and resources, we are positioned to deliver enhanced vision care that sets new standards in the field of ophthalmology.

We look forward to the exciting opportunities ahead as we continue to lead the way in vision care innovation. Stay tuned for more updates as we embark on this new chapter together!

COPHy: Still Delivering Disruption

The "pro"- and "anti"-AI debate took on a touch of pathetic fallacy at this year's Controversies in Ophthalmology meeting

Among the many pertinent topics explored at the 2025 Controversies in Ophthalmology meeting (COPHy) – which took place in an unseasonably rainy Seville, Spain last month (4-5 April) – were discussions on whether AI can overtake humans in making accurate and timely decisions in clinical practice.

In the glaucoma space, the UK's Francesca Cordeiro argued for the human advantage in collaborative decision-making, complex case management, and taking a holistic approach to diagnosis, while pointing to the current limitations of AI, such as limited training data and algorithmic bias. The pro-AI argument, presented by Spain's Marta Pazos, made the case for AI's diagnostic accuracy, cost-effective glaucoma screening, and risk profiling ability.

The debate was heating up nicely when suddenly the Spanish downpour burst through the unprepared session-room ceiling, bringing a temporary halt to the proceedings.

I couldn't help thinking: was this the natural world asserting its dominance, or a warning that we should be forfeiting the "volatility" of reality for the clean precision of artificial intelligence?

Anyway, order was soon restored. But that, of course, was thanks to human effort!

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The Mental Health Costs of DED

Study sheds light on the quality-of-life impact of dry eye disease

A new study published in The Ocular Surface (July 2025) has provided fresh insights into the quality-of-life burden of dry eye disease (DED). Using real-world data from the international Save Sight Dry Eye Registry (SSDER), the authors note a pressing need for individualized treatment strategies for DED patients.

The study was undertaken by a team of ophthalmologists, optometrists, and researchers from Australia, New Zealand, the United Kingdom, Spain, France, Germany, and Nepal. A key finding revealed that individuals with mixed subtype DED (a combination of evaporative and aqueous-deficient DED), corneal neuropathic pain, a history of DED treatment, or past DED-related procedures had significantly worse symptoms, greater activity limitations, and reduced overall quality of life than those with only evaporative or aqueous-deficient DED alone. The finding suggests that mixed DED may represent a more advanced disease stage, correlating with greater impairment.

"We used Rasch analysis, a modern psychometric method, to refine commonly used dry eye assessment tools and generate reliable Quality of Life [QoL] data," explains Himal Kandel, Kornhauser Research Fellow at The University of Sydney and lead author of the study. "Our results highlight that DED is more than just a clinical condition – it significantly affects mental health, daily activities, and overall well-being."

Gender disparities also figure, with women more frequently diagnosed with DED than men, even though the QoL impacts, once diagnosed, were similar across both genders.

The study also found a weak or non-existent correlation between clinical signs of DED and patient-reported symptoms, underscoring the need for independent assessment of both in clinical practice.

In terms of mental health impacts of the disease, the findings suggested that DED patients may benefit from psychological support. Anxiety-related concerns were more prevalent for DED patients than depression-related issues. DED symptoms were found to play a more significant role in mental health outcomes than clinical signs, visual acuity, or age.

Patients who were diagnosed with corneal neuropathic pain were observed to experience worse symptoms, greater activity limitations, and poorer mental health when compared to patients without neuropathic pain.

The study authors note that the Ocular Surface Disease Index (OSDI), the most commonly used questionnaire for DED, may benefit from validation with modern psychometric methods to ensure it provides an accurate assessment of dry eye disease-related quality-of-life impacts.

"These findings reinforce the need for a holistic approach to DED management," adds Fiona Stapleton, Scientia Professor at the School of Optometry and Vision Science, UNSW Sydney. "A comprehensive assessment that includes both signs and symptoms is critical to ensure optimal patient care."

Stephanie L Watson, study co-author and Chief Investigator of the Save Sight Dry Eye Registry project, added, "As DED continues to be a significant public health concern, studies like this pave the way for more effective, evidence-based management strategies that prioritise patient well-being and quality of life improvement."

Iris Cysts

The image of confluent iris cysts was made on film using a photo slit lamp. The cysts were 360º and after making the proper medical documentation of the entire extent of the cysts, I moved the light source to the extreme left and positioned the light to fall tangentially across only half of the pathology to create a more visually pleasing image.

Credit: © Mark Maio www.markmaio.com

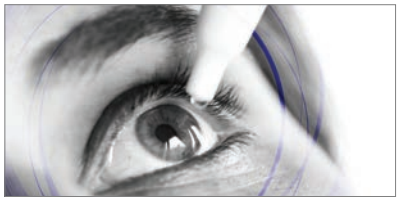
QUOTE *of the month*

"Someone once told me that your kids will never remember that great talk you gave or that extra patient you saw or that complex surgery you did. But they are going to remember if you showed up to their baseball game."

Priya Vakharia, ophthalmologist at Retina Vitreous Associates of Florida, and collaborative assistant professor at the University of South Florida/Morsani College of Medicine.

Full of Pep

Peptide-based eye drops show promise as RP treatment, slowing photoreceptor degeneration in animal models



Credit: Adobe Stock

A Communications Medicine study has posited peptide eye drops as a minimally invasive therapy for slowing photoreceptor loss in retinitis pigmentosa (RP). Conducted by an international research team, the study demonstrated that two peptide-based drops – H105A and 17-mer – successfully preserve photoreceptors, and improve retinal function in both murine models and human retinal organoids.

With most RP treatments currently focused on managing symptoms rather than halting disease progression, the study explored pigment epithelium-derived factor (PEDF)-based peptides, known for their neuroprotective properties, and tested the two peptide candidates as potential therapeutic agents.

The study marks an advancement in the search for non-invasive treatments for retinal degenerative diseases. The success of H105A eye drops suggests that topical peptide-based treatments could become a viable alternative to intravitreal injections in the future, potentially reducing the need for more invasive procedures.

References

1. *A Bernardo-Colón et al., "H105A peptide eye drops promote photoreceptor survival in murine and human models of retinal degeneration," Commun Med (Lond), 21, 81 (2025). PMID: 39109177.*

Embracing an Interventional Mindset

Some thoughts on the evolving world of interventional glaucoma

By Deborah Ristvedt

Within contemporary medicine, glaucoma is defined as an optic neuropathy, partially affected by intraocular pressure, that will eventually lead to vision loss. However, there is so much that we still do not know about the disease, including why some patients continue to progress despite having ostensibly normal pressures. The good news is that most patients in the US present with mild-to-moderate primary open-angle glaucoma (POAG), and so face a good chance of holding steady with the proper treatment.

As intraocular pressure (IOP) is the only modifiable risk factor for POAG, previous treatment options have included laser, drops, more drops, as well as trabeculectomy and tube shunts. But over the last decade there has been a dramatic shift in how we think about glaucoma care. The renewed focus is on patients' quality of life and compliance, on reducing topical drops, and a belief in earlier interventions performed in a safe and effective manner.

In 2011 I joined my dad in practice as a third-generation comprehensive ophthalmologist. The following year, I started my journey into the world of minimally invasive glaucoma surgery (MIGS) with the first-generation iStent. Out of curiosity and a true need for alternatives, I began investigating how glaucoma care might be redefined. I started by looking at the angle in every cataract patient, as this set-up in surgery was all new to me. My iStent cases were in combination with cataract surgery, and there was a learning curve to perfecting this view of the angle, while also really trying to comprehend the angle, the position, and the force required to apply this tiny device.

This step started a journey that now evolved into caring for glaucoma patients in a very different way than before. And I'm grateful to say on the way I've had many opportunities to meet individuals who share my passion for redefining what glaucoma care should look like. In the summer of 2024, some of us sat in a conference room and attempted to define what the treatment algorithm for the various stages of POAG might look like. Our collaborative and solution-based discussions led to the establishment of a new Interventional Glaucoma Treatment protocol that could help to reset and revitalize the stage for glaucoma care.

Since its inception, interventional glaucoma has been defined as a mindset with some key messaging attached: 24/7 IOP lowering, early intervention with safe and effective options, a lessening of drop dependence, halting visual field (VF) progression, and – most importantly – improving patients' quality of life. Now, after the publication of several papers describing the benefits of early intervention in optimizing the natural outflow pathway, as well as the decreasing need for more invasive procedures over time, this mindset has gradually evolved.

Selective laser trabeculoplasty (SLT) as a first-line therapy has allowed us to offer a viable alternative to topical drops. Procedural pharmaceuticals – such as Durysta and iDose TR – have shown the benefits of sustained-release of medication in the eye, even lasting beyond the proposed duration, without any observed side-effects. Furthermore, MIGS can be performed in a sequential order, depending on whether it is in combination with cataract surgery or standalone. We also have tissue-sparing devices and techniques available, such as stenting and canaloplasty, and tissue removal of the trabecular meshwork (TM) in the form of goniotomy; we have a full spectrum of how to treat the outflow pathway, depending on the stage of glaucoma and the need for meeting a certain IOP goal. All this is in addition to other options for bypassing the angle completely, such as minimally invasive bleb surgery or micro pulse laser.

With all of these options available to surgeons,we can start to really think about glaucoma as a long-term game, factoring in severity, age, and IOP goal, amongst other things. Ophthalmologists' curiosity about the disease has now honed in on the cellular level – understanding inflow and outflow. And we now see that long-term topical medication could have a negative impact on the trabecular meshwork, whereas intracameral medication can potentially have a positive impact on outflow. We also see how some new Mechanism of Action (MOA) medications, such as ROCK inhibitors, work more effectively after a MIGS procedure, as well as being one of the only medications to also lower episcleral venous pressure.

In the world of interventional glaucoma, this collective curiosity about the disease has become creative, intuitive, and strategic. But it's not simply investigational – rather, we understand glaucoma differently and are learning to become proactive rather than reactive to the disease. Interventional glaucoma offers an incredible opportunity both to our glaucoma patients and the broader profession.

The Ideal Exit: How to Retire on Your Terms

Five exit strategies every eye surgery practice owner should know

By Rod Solar

1. Exit the line
The first step is moving from being the "solopreneur" performing every task to managing a team that handles patient care. You've likely taken a few steps through this exit already (by hiring an admin assistant, a telephone receptionist, or an optometrist). However, you're still working in the business instead of on the business. The rule here is that if someone else can do it, hire them. This mindset shift lets you focus less on the daily grind and more on strategy, marketing, and scaling your business. It's the foundation for building a practice that doesn't rely on you for survival. You achieve this exit strategy through effective delegation.

2. Exit the staff
Next, you build a leadership team and implement systems to keep the practice running smoothly without your constant oversight. This is the most impactful exit you can make while still in the business. This is when you step fully into the CEO role – not just in title, but in function. A true CEO operates on the business. With a clear scalable operating system in place, you can delegate key responsibilities to your leadership team, allowing you to focus on growth and expansion. The test for this exit strategy is that you can leave the business for 30 consecutive days while your business continues to grow without you present. As the CEO, you are responsible for steering the business forward toward the vision you've established – your team makes it a reality.

3. Exit the organizational chart
Some practice owners enjoy staying involved but don't want to deal with day-to-day operations. In this stage, you step away from running the business but remain engaged as a strategic advisor or board member. This lets you maintain influence while freeing up your time for other pursuits, whether developing a new business line, mentoring others, or simply enjoying your life outside of work. To achieve this exit, you need an operator (a Chief Operating Office [COO] or a General Manager) who manages your operations. You no longer have a job title and now sit on the board. Yes, you need a board. A board is just a fancy word for having a team of advisors who bring to the table what you don't (knowledge, relationships, and experience). That said, you might remain CEO, and still care about the business more than anyone else.

4. Exit governance
This stage involves stepping back from even advisory roles, transitioning into an investor who benefits from the success of the business without any governance responsibilities. Here, you reap the rewards of dividends, distributions, and financial freedom while trusting the systems and leadership team you've built to keep the business thriving. You are now a passive investor. Now, you are above the business. Your current product or service is the business, not eye surgery.

5. Exit ownership
Finally, the most well-known exit: selling your business entirely. Whether it's to a private equity group, another surgeon, or a larger healthcare network, this step allows you to cash in on the value you've built and move on to your next chapter – whether that's retirement, starting a new venture, or simply enjoying the fruits of your labor. Entrepreneurship is a journey filled with highs and lows, but few moments are as rewarding as taking your practice to the next level.

That's precisely what happened for one of my clients, a visionary refractive surgeon who recently accomplished two significant milestones: making a key hire and upgrading their practice's operational systems. These steps marked their official transition from practitioner to truly leading their business as CEO, setting the stage for even greater success.

For many practice owners, stepping back from the chair or preparing to exit their business feels overwhelming. However, understanding the five exits of the entrepreneur can help you align your actions with your long-term goals. Below, I'll break down the five exit strategies every eye surgery entrepreneur should consider – and how each one paves the way toward the freedom you've worked so hard to achieve.

Which exit strategy is right for you?
Over the next 12 to 18 months, which of these exits would set you up for the freedom and success you envision? Note, you can't skip the first three steps and receive the greatest potential value for your business when you take exit number 5.

The path you choose will depend on your goals, your vision for your practice, and your desired lifestyle. I've designed my Scale & Exit Program to help eye surgery entrepreneurs double their revenue, triple their profits, and achieve their ideal exit in three years or less.

Owning your practice gives you the freedom to grow as much – or as little – as you want. With the right guidance and support, you can achieve an exit that reflects your hard work and sets you up for a future of choice and freedom.

Ready to map out your ideal exit? Let's build the roadmap together.

Damien Gatinel: Power List Perspectives

Our Power Lister winners explore the major trends in their field, and the seismic impact AI and machine learning is having on the profession

Damien Gatinel, Head of the Refractive and Anterior Segment Surgery Department at the Rothschild Foundation, Paris, offers his thoughts on the trends and technologies that are currently transforming the cataract and refractive surgery space.

What major trends in cataract and refractive surgery are catching your attention right now?

I'm consistently fascinated by the inventiveness of implant manufacturers who manage to conjure up clever semantic twists to position their lenses as singular, groundbreaking advancements. In reality, most of these so-called "innovations" are simply variations on the same core themes – whether refractive, diffractive, or hybrid optical systems. I find it both amusing and commendable how adept they've become at highlighting incremental enhancements, ensuring that our field is rarely short on new acronyms or exciting marketing buzzwords. That said, it does keep us on our toes, prompting us to carefully evaluate the genuine clinical benefits behind each "next big thing."

What advice would you give to your younger self?

- **Embrace pluridisciplinarity.** Collaborate with experts from diverse backgrounds – engineers, data scientists, optometrists, and healthcare managers – to enrich your perspective on patient care, research, and innovation. Consider developing an additional area of expertise to enhance your problem-solving capabilities.
- **Leverage online tools and resources.** Stay current by participating in webinars, virtual conferences, and online forums.
- **Adopt generative AI into your practice.** Use generative AI to streamline tasks such as literature reviews, data analysis, and document drafting. Always validate AI-generated insights with robust evidence and clinical judgment to ensure accuracy and patient safety.
- **Develop a critical mind.** In a field driven by constant technological advances, cultivate healthy skepticism. Regularly question new methods or findings, verify sources, and assess study designs before integrating changes into your clinical practice.
- **Promote continuous learning and adaptability.** Stay open to new techniques, interdisciplinary collaborations, and emerging technologies. Regularly update your skills and embrace lifelong learning through online courses, professional communities, and mentorship opportunities.
- **Maintain ethical and human-centered care.** Technology can improve efficiency, but personal interaction remains at the heart of good medicine. Let compassion, empathy, and clear communication guide your practice, ensuring that patients feel heard and valued.
- **Aim to be the physician and mentor you've always wanted.** A simple way to guide your decisions is to treat patients the way you would want to be treated, and to strive to be the mentor you wish you had. This mindset naturally leads to higher standards of care, ethical behavior, and professional excellence.

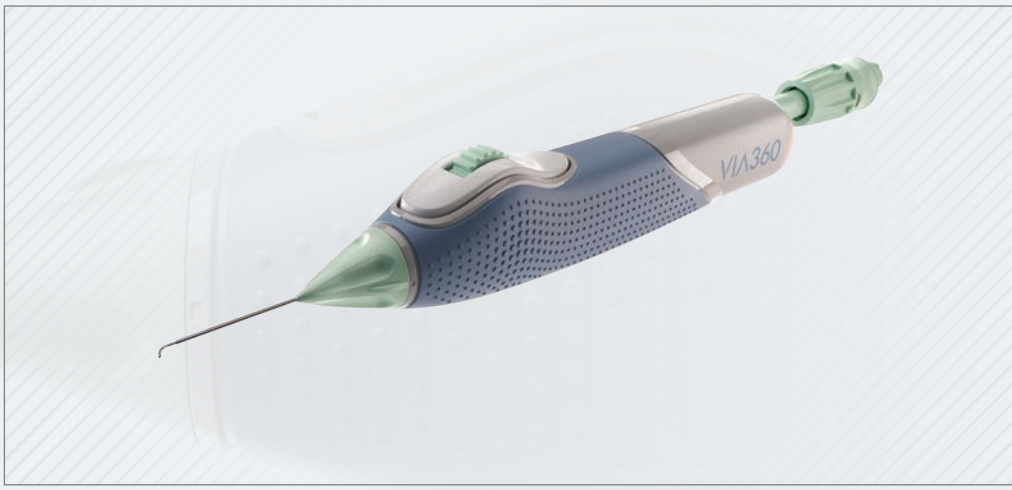
In what ways do you think artificial intelligence (AI) and machine learning will impact cataract and refractive surgery?

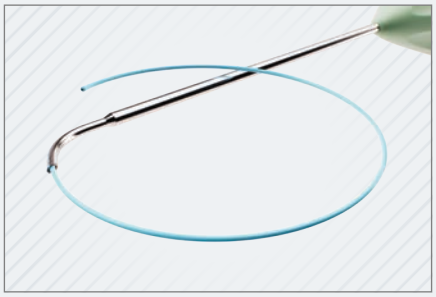
AI and machine learning stand to significantly reshape cataract and refractive surgery by improving both the precision and personalization of patient care. By analyzing extensive datasets, AI-driven systems can generate more accurate predictive models for intraocular lens (IOL) power calculations, dramatically lowering the likelihood of postoperative refractive surprises. These technologies also excel at interpreting complex diagnostic data – such as corneal topography, tomography, and biometric measurements – allowing surgeons to diagnose and treat corneal pathologies with a level of speed and accuracy previously unattainable.

Furthermore, AI-powered algorithms will soon be pivotal in selecting the optimal surgical technique and lens type for each patient, enhancing outcomes through a tailored, individualized approach. During surgery, real-time guidance systems integrated with AI can offer immediate feedback and parameter adjustments based on tissue response and surgeon technique. Beyond the operating room, AI-driven postoperative monitoring and telemedicine platforms promise to expedite follow-up care, enabling earlier detection and intervention for complications – ultimately reducing the burden on patients and improving long-term results.

Enabling Early Intervention with Complete Control

Glaucoma specialist Inder Paul Singh outlines the precision and versatility of the VIA360™ Surgical System for the delivery of viscoelastic fluid during ophthalmic surgery





New World Medical's VIA360™ Surgical System recently received 510(k) clearance from the FDA for the delivery of viscoelastic fluid during ophthalmic surgery. It is also indicated to cut trabecular meshwork tissue during trabeculotomy procedures, and can be used in combination with cataract surgery or as a standalone procedure. The system is designed with features that enhance the overall surgical experience, addressing the limitations of current catheter-based devices.

Ophthalmic surgeon and glaucoma specialist Inder Paul Singh, MD, President of the Eye Centers of Racine & Kenosha, Wisconsin, is an early adopter of the device. To begin with, he told The Ophthalmologist, "for the staff, the set-up time with the VIA360™ Surgical System is extremely efficient. It's very easy to prime with the viscoelastic, and it's very ergonomic. Whether you have small or large hands, it's intuitive to wheel. With just a single entry, the scroll wheel and button allow for smooth catheter extension and retraction. The device can also go through a main incision or a paracentesis, and go up to 360 degrees without having to come out of the eye. A surgeon, if one prefers, can change direction after the first 180 degrees as well providing versatility to the procedure with various techniques."

Among the devices' features is the proprietary ActiveInject™ Technology, which enables on-demand viscoelastic delivery independent of catheter movement. The Smart Prime system optimizes viscoelastic volume (over 100+ µL) to maximize efficiency throughout the procedure. "What makes this unique is that the device releases viscoelastic not just at the tip, but also through the micro-channels along the actual catheter posterior to the tip. So, you have controlled viscoelastic delivery, both forward and tangentially. It gives you the control to press as much as you want, and not only how much viscoelastic you want to deliver , but also when you want to deliver it."

Singh continues: "It allows you to perform a trabeculotomy very efficiently as well. The catheter allows you to cut the trabecular meshwork if you want to, whether it's 360, 180, or 90 degrees. You have that control and flexibility to perform as much of a GATT-type procedure as you like."

While it is early days in terms of assessing patient feedback and outcomes, Singh notes that "I'm seeing good results so far with patients that require only delivery of viscoelastic – no cutting. You don't have to do a cutting-type procedure at the same time to get significant effectiveness."

Advice for surgeons

In this age of minimally invasive glaucoma surgery and interventional glaucoma, "we're coming to the understanding that the earlier we intervene, the better chance we have of optimizing treatment," explains Singh. "It's also important to note that there isn't just one surgery, one procedure, that's going to last forever and be a cure-all. I think it's really important try new things, to be open minded to different technologies, different procedures. Remember, the skill-set you already possess allows you to try different devices."

There is, of course, a learning curve associated with all new devices, Singh adds. "The VIA360™ Surgical System is very efficient and intuitive. So, get your hands on experience in the wet lab, hold the device a few times, and then try a few cases. You can do a good three to four or five cases in a day, at least. And you'll realize between the first and the fourth or fifth case, all of a sudden there's a significant difference in your comfort level, in your muscle memory, visual and tactile cues, which all makes a difference."

Singh concludes, "For me, the technology elevates the efficiency of the procedure by allowing me to deliver viscoelastic exactly where and when it's needed, with complete control at my fingertips."

www.VIA360surgicalsystem.com

Landmark Literature *2024–2025*

Andrzej Grzybowski outlines the advances in ophthalmology research over the last 12 months

For this year's round-up of landmark literature, The Ophthalmologist Power Lister Andrzej Grzybowski curates the most impactful developments across gene therapy, diabetic retinopathy, age-related macular degeneration, glaucoma, and pediatric ophthalmology – as well as the latest research on artificial intelligence models – to offer a broad view of how emerging therapies and tools are being translated into real-world clinical gains.

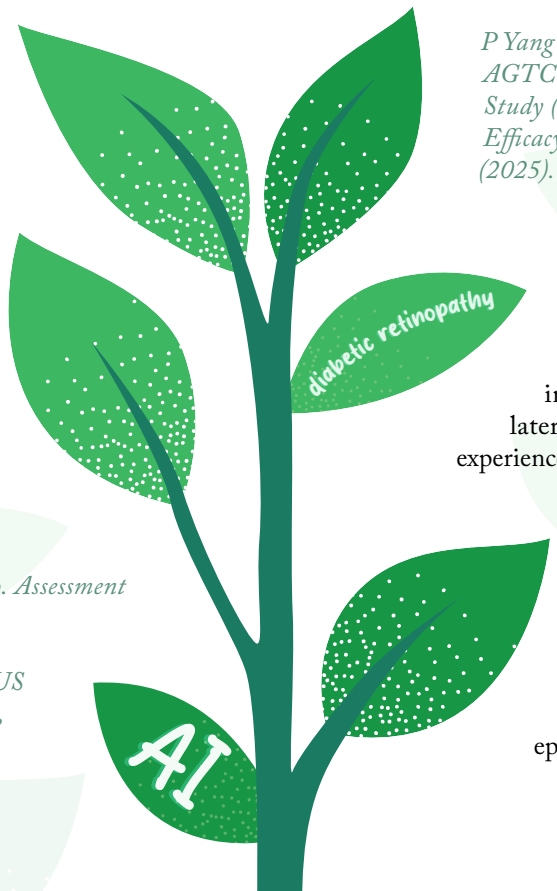
GENE THERAPY

Gene therapy has continued to mature in ophthalmology, targeting both hereditary and non-hereditary retinal diseases. The retina has been a pioneer site for gene therapy in medicine, especially since the US Food and Drug Administration (FDA) approved voretigene neparvovec-rzyl (Luxturna) in December 2017 for the treatment of biallelic RPE65-mediated inherited retinal disease. Luxturna marked the first FDA-approved gene therapy for any inherited disorder, establishing a foundation for further retinal gene therapy research.

M Michaelides et al., "Phase 1/2 AAV5-hRKp.RPGR (Botaretigene Sparoparvovec) Gene Therapy: Safety and Efficacy in RPGR-Associated X-Linked Retinitis Pigmentosa," Am J Ophthalmol., 267, 122 (2024). PMID: 38871269.

In this open-label phase I/II trial, male participants aged ≥5 years with RPGR-associated X-linked retinitis pigmentosa received subretinal AAV5-hRKp.RPGR gene therapy across escalating doses, with 36 randomized into immediate or deferred treatment arms. The therapy was generally well tolerated, with most adverse events being transient and related to surgery; inflammation was effectively managed with corticosteroids. Improvements in retinal sensitivity and functional vision were observed in the immediate treatment group, supporting progression to a phase III trial.

BL Lam et al., "XIRIUS Study Group. Assessment of Visual Function with Cotoretigene Toliparvovec in X-Linked Retinitis Pigmentosa in the Randomized XIRIUS Phase 2/3 Study," Ophthalmology, 131, 1083 (2024). PMID: 38423215.



In this 12-month phase I/II trial (XIRIUS), 29 male patients with RPGR-associated X-linked retinitis pigmentosa were randomized to receive low-dose, high-dose, or no subretinal cotoretigene toliparvovec gene therapy. Although the primary endpoint – proportion of microperimetry responders – was not met, the low-dose group showed significant improvements in mean microperimetry sensitivity and low-luminance visual acuity compared to controls. The low-dose treatment also resulted in fewer ocular serious adverse events than the high-dose group, supporting further investigation of this gene therapy approach.

M Michaelides et al., "Gene therapy in children with AIPL1-associated severe retinal dystrophy: an open-label, first-in-human interventional study," Lancet, 405, 648 (2025). PMID: 39986747.

In this single-arm UK study, four children (aged 1–2.8 years) with AIPL1-associated severe retinal dystrophy received a subretinal injection of rAAV8.hRKp.AIPL1 gene therapy in one eye. Over an average 3.5-year follow-up, treated eyes showed significant improvement in visual acuity (from light perception to ~0.9 logMAR), enhanced cortical activity, and better preservation of retinal structure compared to untreated eyes. The treatment was generally well tolerated, with no serious adverse effects aside from one case of cystoid macular edema.

P Yang et al., "Subretinal Gene Therapy Drug AGTC-501 for XLRP Phase 1/2 Multicenter Study (HORIZON): 24-Month Safety and Efficacy Results," Am J Ophthalmol., 271:268 (2025). PMID: 39643074.

In this phase I/II open-label study, 29 male participants with X-linked retinitis pigmentosa received subretinal injections of AGTC-501 across escalating doses, targeting initially the peripheral retina and later the macula. While all participants experienced treatment-emergent adverse events, most were mild and related to the surgical procedure; serious ocular AEs occurred in 21 percent, including retinal detachment and cataract. Although the highest dose showed the greatest gains in retinal sensitivity, it was associated with concerning retinal pigment epithelial changes, leading investigators

to discontinue that dose in future studies; efficacy was most promising at the maximum tolerated dose.

NON-HEREDITARY RETINAL CONDITIONS

In recent years, the field has rapidly evolved, expanding interest toward gene therapies for non-hereditary retinal conditions as well. Gene therapy works by delivering a therapeutic gene into a patient's cells, enabling sustained production of a functional protein – such as endogenous anti-vascular endothelial growth factor (VEGF) – to achieve long-lasting therapeutic effects. This approach holds promise in reducing or eliminating the need for repeated intravitreal injections. These evolving delivery techniques are being actively explored for their potential in treating common non-inherited retinal diseases such as age-related macular degeneration (AMD), diabetic macular edema (DME), and diabetic retinopathy (DR).

JS Heier et al., "Phase 1 Study of JNJ-81201887 Gene Therapy in Geographic Atrophy Secondary to Age-Related Macular Degeneration," Ophthalmology, 12, 1377 (2024). PMID: 38909914.

In this phase I open-label study, 17 patients with geographic atrophy secondary to advanced dry AMD received a single intravitreal injection of JNJ-81201887 across three dose levels. The gene therapy was well tolerated, with no dose-limiting or serious treatment-related adverse events; mild ocular inflammation occurred in 29 percent of patients and was resolved in most cases. While geographic atrophy lesion growth was stable across all groups, the high-dose cohort showed a continued decline in lesion growth rate over 24 months, supporting further clinical investigation.

PA Campochiaro et al., "Gene therapy for neovascular age-related macular degeneration by subretinal delivery of RGX-314: a phase 1/2a dose-escalation study," Lancet, 403, 1563 (2024). PMID: 38554726.

In this phase I/IIa multicenter US study, 42 participants with neovascular AMD received a single subretinal injection of RGX-314 across five escalating dose cohorts, following prior anti-VEGF therapy. RGX-314 was generally well tolerated, with no unexpected inflammation; one vision-related adverse event occurred at the highest dose, and pigmentary changes were observed at higher dose levels. Sustained VEGF-A suppression was achieved, leading to stable or improved visual acuity and reduced reliance on supplemental anti-VEGF injections, supporting further investigation in larger trials.

EP Rakoczy et al., "Gene therapy with recombinant adeno-associated vectors for neovascular age-related macular degeneration: 1 year follow-up of a phase 1 randomized clinical trial," Lancet, 386, 2395 (2015). PMID: 26431823.

In this phase I randomized controlled trial, nine patients with neovascular AMD received a single subretinal injection of low- or high-dose rAAV.sFLT-1 gene therapy or no treatment, alongside standard anti-VEGF therapy. The gene therapy was safe and well tolerated, with only mild, self-limiting procedure-related adverse events and no evidence of chorioretinal atrophy. Two-thirds of treated patients required no rescue anti-VEGF injections during follow-up, supporting the potential of rAAV.sFLT-1 as a long-term treatment for wet AMD.

STEM CELL–BASED REGENERATIVE THERAPIES

UV Jurkunas et al., "Cultivated autologous limbal epithelial cell (CALEC) transplantation for limbal stem cell deficiency: a phase I/II clinical trial of the first xenobiotic-free, serum-free, antibiotic-free manufacturing protocol developed in the US," Nat Commun., 16, 1607 (2025). PMID: 40038272.

In this phase I/II single-arm clinical trial, researchers evaluated a novel two-stage, xenobiotic-free process for manufacturing cultivated autologous limbal epithelial cells (CALEC) to treat unilateral limbal stem cell deficiency (LSCD). Among 15 enrolled participants, 93 percent of CALEC grafts met release criteria, and no serious safety events related to treatment were observed. The majority of patients achieved either complete or partial clinical success (92 percent by 18 months), supporting the safety, feasibility, and potential efficacy of CALEC transplantation for LSCD. Notably, all participants met complete success criteria at least once, with most maintaining that success across subsequent visits, suggesting durable ocular surface stability. Of the five participants who transitioned from complete to partial or no success, the majority had complex clinical histories or required retreatment – indicating that baseline disease severity may influence long-term graft performance.

T Soma et al., "Induced pluripotent stem-cell-derived corneal epithelium for transplant surgery: a single-arm, open-label, first-in-human interventional study in Japan," Lancet, 404, 1929 (2024). PMID: 39522528.

In this first-in-human clinical study, four patients with limbal stem cell deficiency received corneal epithelial cell sheets derived from allogeneic human induced pluripotent stem cells (iCEPSs). Over a two-year follow-up, the treatment was well tolerated, with no serious adverse events such as tumor formation or immune rejection. Improvements in corneal clarity, visual acuity, and disease stage were observed in all cases – most notably in patients receiving

"Evolving gene therapy delivery techniques are being actively explored for their potential in treating common non-inherited retinal diseases..."

low-dose immunosuppression – supporting the potential of iPSC-based therapies for LSCD and warranting further clinical trials.

DIABETIC RETINOPATHY TREATMENT

AJ Barkmeier et al., "Comparative Effectiveness of Glucagon-Like Peptide-1 Receptor Agonists, Sodium-Glucose Cotransporter 2 Inhibitors, Dipeptidyl Peptidase-4 Inhibitors, and Sulfonylureas for Sight-Threatening Diabetic Retinopathy," Ophthalmol Retina, 8, 943 (2024). PMID: 38735641.

In this large retrospective cohort study of 371,698 adults with type 2 diabetes and moderate cardiovascular risk, researchers compared the impact of different glucose-lowering therapies on the risk of developing sight-threatening diabetic retinopathy. Patients initiating SGLT2 inhibitors had a significantly lower risk of requiring treatment for diabetic macular edema or proliferative retinopathy compared to those starting GLP-1 receptor agonists, DPP-4 inhibitors, or sulfonylureas (HRs: 0.73, 0.79, and 0.61 respectively). The findings support a potential protective role of SGLT2 inhibitors in diabetic eye disease progression.

H Tesfaye et al., "Empagliflozin and the Risk of Retinopathy in Patients With Type 2 Diabetes," JAMA Ophthalmol., 143, 62 (2025). PMID: 39636645.

In this large observational cohort study using US insurance data, researchers compared the effects of empagliflozin and DPP4 inhibitors on DR risk in adults with type 2 diabetes. Initiation of empagliflozin was not associated with a reduced risk of incident nonproliferative DR, but it was linked to a significantly lower risk of DR progression (HR 0.78; 95 percent CI, 0.63–0.96). While residual confounding cannot be excluded, these findings suggest empagliflozin may offer protective effects against worsening retinal disease in this population.

D Preiss et al., "Effect of Fenofibrate on Progression of Diabetic Retinopathy," NEJM Evid., 3, EVIDoa2400179 (2024). PMID: 38905569.

In this randomized trial of 1,151 adults with nonreferable diabetic retinopathy or maculopathy, fenofibrate (145 mg) significantly reduced progression to referable disease or the need for treatment compared to placebo over a median follow-up of 4 years. The hazard ratio for disease progression was 0.73 (P=0.006), and for macular edema, it was 0.50, though no improvements were observed in visual function or quality of life. While fenofibrate modestly reduced progression of early diabetic retinal changes, it had no effect on vision outcomes and was associated with a small decline in renal function.

S Klier et al., "Safety and Efficacy of Senolytic UBX1325 in Diabetic Macular Edema," NEJM Evid. 4, EVIDoa2400009 (2025). PMID: 40261111.

In this sham-controlled trial, 65 patients with diabetic macular edema and suboptimal prior response to anti-VEGF therapy were randomized to receive a single intravitreal injection of UBX1325 or sham. UBX1325 was generally well tolerated, with no treatment-emergent adverse events leading to discontinuation, and safety profiles were comparable between groups. A modest visual benefit was observed with UBX1325, showing a 5.6-letter gain in visual acuity at 48 weeks versus sham, warranting further investigation in larger trials.

AGE-RELATED MACULAR DEGENERATION (AMD) TREATMENT

TL Jackson et al., "Stereotactic radiotherapy for neovascular age-related macular degeneration (STAR): a pivotal, randomized, double-masked, sham-controlled device trial," Lancet, 404, 44 (2024). PMID: 38876132.

In the STAR randomized controlled trial, 411 patients with chronic active neovascular age-related macular degeneration (nAMD) received either 16-Gy stereotactic radiotherapy (SRT) or sham treatment alongside anti-VEGF injections. Over two years, SRT significantly reduced the number of injections required (mean reduction of 2.9) without compromising visual acuity, which remained non-inferior to sham. Although microvascular changes were more common in the SRT group, they were not associated with worse vision, and the treatment offered a potential cost-saving benefit, supporting its role in reducing injection burden in nAMD.

CC Xue et al., "Omega-3 Fatty Acids as Protective Factors for Age-Related Macular Degeneration: Prospective Cohort and Mendelian Randomization Analyses," Ophthalmology, 132, 598 (2025). PMID: 39662686.

In this large prospective cohort and Mendelian randomization study, higher plasma levels of omega-3 fatty acids and DHA were significantly associated with reduced risk of AMD. Over nearly 13 years of follow-up in the UK Biobank, individuals with elevated omega-3 and DHA had lower rates of AMD, and genetic analyses confirmed a likely causal relationship, particularly for both dry and wet AMD. These findings support the protective role of omega-3 and DHA against AMD and highlight the potential value of clinical trials targeting these nutrients for AMD prevention.

PEDIATRIC OPHTHALMOLOGY

FA Proudlock et al. [EUPatch study group], "Extended optical treatment versus early patching with an intensive patching regimen in children with amblyopia in Europe (EuPatch): a multicenter, randomized controlled trial," Lancet, 403, 1766 (2024). PMID: 38704172.

In the EuPatch randomized controlled trial involving 334 children with amblyopia, early patching after just 3 weeks of glasses wear led to significantly better treatment success than extended optical treatment (EOT) before patching. After 12 weeks of patching, 67 percent of the early patching group achieved successful outcomes, compared to 54 percent in the EOT group (p=0.019). The findings support initiating intensive patching earlier to improve visual outcomes and provide evidence to personalize amblyopia management strategies.

DL Li et al., "Lower indoor spatial frequency increases the risk of myopia in children," Br J Ophthalmol., 109, 250 (2025). PMID: 39122351.

In this study of 566 children, researchers found that indoor environments exhibited significantly lower spatial frequency content than outdoor spaces, and this reduction was linked to myopia. Myopic children were more likely to have been exposed to indoor environments with lower spatial frequency slopes, while no difference was observed in outdoor spatial frequency. Regression analysis confirmed that lower indoor spatial frequency was associated with increased myopia risk, highlighting the visual environment's potential role in myopia development.

GLAUCOMA

J Jiang et al., "CRISPR-Cas9-mediated deletion of carbonic anhydrase 2 in the ciliary body to treat glaucoma," Cell Rep Med., 5, 101524 (2024). PMID: 38670096.

A study introduced a transformative gene therapy for glaucoma by using a CRISPR-Cas9 system delivered via ShH10 AAV to permanently knock out the carbonic anhydrase 2 (Car2) gene in the ciliary body, the source of aqueous humor. The single intravitreal injection led to sustained intraocular pressure (IOP) reduction in multiple glaucoma models, surpassing conventional treatments like brinzolamide. The study presents a potential one-time, disease-agnostic gene-editing approach to manage glaucoma, though long-term safety in primates remains to be assessed before clinical use.

HISTORY OF OPHTHALMOLOGY

J Jiang et al., "CRISPR-Cas9-mediated deletion of carbonic anhydrase 2 in the ciliary body to treat glaucoma," Cell Rep Med., 5, 101524 (2024). PMID: 38670096.

In 2024 we celebrated the 75th anniversary of the first intraocular lens (IOL) implantation. This historical review clarifies the pioneering development of the IOL by Harold Ridley, who implanted the first permanent IOL in 1950 following inspiration from wartime findings on inert acrylic fragments. Ridley used Transpex I, an acrylic material known for its biocompatibility, though early designs caused significant refractive errors and inflammatory reactions due to inadequate sterilization. Despite initial setbacks, Ridley's work laid the foundation for modern cataract surgery, proving by 1951 that intraocular lenses could achieve successful visual outcomes.

ARTIFICIAL INTELLIGENCE: FOUNDATION MODELS IN OPHTHALMOLOGY

A foundation model is a large, general-purpose artificial intelligence (AI) model that is trained on a vast and diverse dataset using self-supervised or unsupervised learning. Once pretrained, it can be adapted (or "fine-tuned") for a wide range of downstream tasks – often with minimal additional labeled data. Foundation models serve as universal starting points for building specialized AI applications. In medical fields like ophthalmology, foundation models:

- Reduce the need for large, labeled clinical datasets.
- Improve generalization across patient populations, devices, and imaging settings.
- Enable multitask and multimodal workflows (e.g., combining retinal images with clinical notes or demographics).
- Provide building blocks for safer, more scalable AI systems (e.g., RETFound for retinal disease).

"Foundation models serve as universal starting points for building specialized AI applications."

Y Zhou et al., "A foundation model for generalizable disease detection from retinal images," Nature, 622, 156 (2023). PMID: 37704728.

This seminal study, published in 2023, introduced the first foundation model to ophthalmology, the RETFound model, based on self-supervised masked autoencoders and pretrained on 1.6 million unlabeled retinal images. It outperformed traditional ImageNet models in diagnosis, prognosis, and systemic disease prediction, requiring fewer labeled samples. RETFound marked the shift to foundation models for retinal disease detection.

IN 2024, SEVERAL IMPORTANT STUDIES SHOWED NEW APPLICATIONS AND PERFORMANCE OF FOUNDATION MODELS IN OPHTHALMOLOGY

J Zhang et al., "RETFound-enhanced community-based fundus disease screening: real-world evidence and decision curve analysis," NPJ Digit Med., 7, 108 (2024). PMID: 38693205.

RETFound was adapted to real-world community screening in China, showing >15 percent better sensitivity and specificity compared to commercial AI tools. The model demonstrated high resilience to poor imaging conditions. Decision curve analysis confirmed a significant net benefit for both rural and urban screening.

C Nielsen et al., "Foundation model-driven distributed learning for enhanced retinal age prediction," J Am Med Inform Assoc., 31, 2550 (2024). PMID: 39225790.

Using a compressed RETFound version, a distributed learning system predicted retinal age gaps. Federated and traveling model learning achieved equivalent accuracy to centralized training but were more computationally efficient.

K Du et al., "Detection of Disease Features on Retinal OCT Scans Using RETFound," Bioengineering (Basel), 11, 1186 (2024). PMID: 39768004.

Study	Modalities	Dataset Size	Tasks Supported	Performance
VisionFM (Qiu et al., 2024)	Fundus, OCT, OCTA, FFA, Slit-lamp, UBM, B-scan, MRI	3.4M images (560k individuals); 53 public + 12 private test datasets	Diagnosis, Prognosis, Segmentation, Landmark Detection, Systemic Disease Prediction	AUROC 0.950 (8 disease classes); 0.974 (OCT-AMD); Competitive vs ophthalmologists
FMUE (Peng et al., 2025)	OCT	19,655 internal; 5,175 external-private; 6,182 external-public	Retinal disease classification with uncertainty estimation	F1 95.7% (internal), 94.7% (external-private), 77.1% (external-public); AUC up to 98.9%
RETFound (Zhou et al., 2023)	Fundus (CFP), OCT	1.6M retinal images (904k CFP, 736k OCT)	Diagnosis, Prognosis, Systemic Disease Prediction	AUROC 0.943 (DR), 0.862 (wet-AMD prognosis), 0.737–0.794 (MI, stroke, heart failure)
HyMNet (Baharoon et al., 2024)	Fundus + Demographics (age, sex)	5,016 images (1,243 individuals)	Hypertension prediction	F1 0.771 (overall); 0.796 (diabetic); AUC not explicitly given
Zhang et al., 2024 (Myopic Maculopathy)	Fundus	2,159 annotated images	5-class myopic maculopathy classification	Accuracy 95.4%, AUC 0.995, F1 95.3%, Kappa 0.976

Table 1. Comparison of Foundation Model Studies in Ophthalmology

This study evaluated RETFound, a foundation model pretrained on OCT images, for automated classification of retinal disease features, comparing its performance to ResNet-50 using a labeled dataset. RETFound achieved comparable accuracy and AUC-ROC values, demonstrating its potential to support more efficient and consistent OCT image interpretation in clinical settings.

MS Chen et al., "Independent Evaluation of RETFound Foundation Model's Performance on Optic Nerve Analysis Using Fundus Photography," Ophthalmol Sci., 28, 100720 (2025). PMID: 40161459.

This study assessed RETFound for predicting optic nerve metrics like cup-to-disc ratio and RNFL thickness from fundus images. RETFound outperformed VGG16 and ViT feature extractors, achieving high R^2 values (up to 0.961) in single-output tasks, though performance was lower in multioutput predictions. These results highlight RETFound's potential to enable accurate optic nerve evaluation from fundus photos, even without task-specific training.

D Kuo et al., "How Foundational Is the Retina Foundation Model? Estimating RETFound's Label Efficiency on Binary Classification of Normal versus Abnormal OCT Images," Ophthalmol Sci., 5, 100707 (2025). PMID: 40161460.

This study evaluated the label efficiency of the RETFound model for classifying normal vs. abnormal OCT B-scans in diabetic retinopathy screening. RETFound consistently outperformed ResNet-50 and standard ViT models across all dataset sizes, particularly excelling with limited training data. These results highlight the value of retina-specific pretraining and suggest RETFound's strong potential for scalable, label-efficient ophthalmic diagnostics.

B Chuter et al., "Evaluating a Foundation Artificial Intelligence Model for Glaucoma Detection Using Color Fundus Photographs," Ophthalmol Sci., 5, 100623 (2024). PMID: 39650567.

This study evaluated RETFound's performance in detecting glaucoma from optic disc photographs across varying training sizes, epochs, and patient subgroups. RETFound achieved

strong accuracy (AUC up to 0.86), with performance improving with more data and training, and remaining consistent across age and race. Its adaptability and effectiveness, even with limited data, highlight RETFound's potential for scalable, automated glaucoma detection in diverse clinical settings.

T Lin et al., "Efficiency and safety of automated label cleaning on multimodal retinal images," NPJ Digit Med.. 5, 10 (2025). PMID: 39757295.

This study evaluated automated label cleaning using Cleanlab in noisy fundus and OCT datasets, demonstrating substantial improvements in label accuracy (up to 62.9 percent) and dataset quality. RETFound's classification accuracy improved significantly (up to 52.9 percent) when trained on cleaned data, with most label errors accurately corrected and minimal over-cleaning using a DQS-guided strategy. These findings highlight the effectiveness and safety of automated label correction in improving model training and dataset reliability.

IN 2024 AND 2025 NEW FOUNDATION MODELS WERE DEVELOPED (TABLE 1).

J Qui et al., "Development and validation of a multimodal multitask vision foundation model for generalist ophthalmic artificial intelligence," NEJM AI, 1 (2024). DOI: 10.1056/ AIoa2300221.

VisionFM is a multipurpose ophthalmic foundation model pretrained on 3.4 million images spanning eight imaging modalities and diverse diseases, designed to generalize across clinical tasks. It outperformed baseline models in internal and external validations, achieving AUROCs up to 0.974 and showing diagnostic accuracy comparable to intermediate-level ophthalmologists. VisionFM demonstrated strong generalizability to unseen modalities and tasks, supporting its potential as a scalable, open-source platform for broad ophthalmic AI applications.

M Baharoon et al., "HyMNet: A multimodal deep learning system for hypertension prediction using fundus images and cardiometabolic risk factors," Bioengineering, 11, 1080 (2024). PMID: 39593740.

HyMNet combined RETFound-based imaging features and demographic factors for hypertension detection. It achieved an F1 score of 0.771, especially improving prediction among diabetic patients.

Z Zhang et al., "Effective automatic classification methods via deep learning for myopic maculopathy," Front Med (Lausanne). 11:1492808 (2024). PMID: 39606624.

An ensemble deep learning system using RETFound, ViT, and ResNet achieved 95.4 percent accuracy in classifying myopic maculopathy. The system demonstrated excellent performance in complex retinal disease detection tasks.

Y Peng et al., "Enhancing AI reliability: A foundation model with uncertainty estimation for optical coherence tomography-based retinal disease diagnosis," Cell Rep Med., 6, 101876 (2025). PMID: 39706192.

A foundation model with uncertainty estimation (FMUE) to detect 16 retinal conditions on optical coherence tomography was developed. In the internal test set, FMUE achieved a higher F1 score of 95.74 percent than other state-of-the-art algorithms (92.03 percent-93.66 percent) and improved to 97.44 percent with threshold strategy. In human-model comparison, FMUE achieved a higher F1 score of 96.30 percent than retinal experts (86.95 percent, $p = 0.004$), senior doctors (82.71 percent, $p < 0.001$), junior doctors (66.55 percent, $p < 0.001$), and generative pretrained transformer 4 with vision (GPT-4V) (32.39 percent, $p < 0.001$).

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ANTERIOR SEGMENT

Advocating for Early Vitrectomy in Open Globe Injuries

Michael Mikhail details his lessons learned from managing complex trauma cases in low-income settings

Lessons learned from managing complex trauma cases in low-income settings

Ocular trauma is unfortunately an all-too-common presentation at Kabgayi Eye Unit (KEU) in Rwanda, where I work as a consultant ophthalmologist and vitreoretinal surgeon. This article is a reflection of my experience managing such cases, focusing specifically on advocating for early vitrectomy. I will not delve into the techniques of primary repair, as they are beyond the scope of this discussion.

The concept of test-driving their vision before committing to a final prescription resonates with patients. It reframes cataract surgery as a customizable experience, giving them a sense of control and reassurance that we will get their vision exactly right. I think reframing the patient conversation from spectacle independence to quality of vision opened the door to a new patient population who normally would have opted for a standard monofocal IOL.

Initial challenges

When I first arrived at KEU, there had been no vitreoretinal (VR) surgeon for two years. This gap had left a tsunami of cases with post-traumatic complications, most notably closed funnel retinal detachment with phthisis, leading to a staggering 50 percent enucleation rate in these eyes. Unfortunately, these cases confirmed what I had already observed on my arrival: the absence of timely vitrectomy left these eyes vulnerable to irreversible damage. My approach to managing these cases, including the emphasis on early vitrectomy, was shaped by insights from a VR colleague in Rwanda, whose expertise has been invaluable.

The reasons for such poor outcomes are multifactorial:

- Vitreous incarceration into the wound with fibrovascular growth on the vitreous scaffold, as demonstrated by Cleary et al. (1). This has led to the development of proliferative vitreoretinopathy (PVR), which can develop within days leading to tractional retinal detachment. Posterior vitrectomy eliminates stimulating factors for PVR and removes the scaffold for proliferation, but this should be done within the first week after trauma.
- Another important factor – less known to many – is the contraction of the lens capsule if not removed during the initial lensectomy. So, if the lens including posterior capsule is damaged and violating the vitreous, I would advocate for complete removal of the lens, including the entire bag, as contraction of the capsule can cause traction on the ciliary body and ciliary processes, inevitably contributing to phthisis bulbi.
- Lens particles, vitreous, and blood together are the perfect "recipe" for anterior PVR, which can also cause traction on the ciliary body.

Existing studies support my observation, with one large series reporting a 29 percent risk of retinal detachment after open globe injury, with up to 70 percent of such eyes developing retinal detachment within a month if not addressed early (2). This evidence underscored my belief that early vitrectomy is not merely a therapeutic procedure but a prophylactic one, aiming to prevent retinal detachment before it occurs.

Additionally, Chauhan et al., in a retrospective analysis of 110 trauma patients undergoing PPV that sought to emphasize the time of surgical intervention, found that same-day vitrectomy yielded the best final VA and lowest rates of PVR and enucleation, regardless of aetiology (3).

Identifying occult scleral ruptures

Before exploring surgical techniques, I must stress the importance of maintaining a low threshold for suspecting occult scleral rupture. If the mechanism of injury involves equatorial distension – such as being struck by an object that compresses the globe – clinicians should carefully evaluate for the following signs:

- poor vision
- relative afferent pupillary defect
- severe subconjunctival haemorrhage

- vitreous haemorrhage
- a deep anterior chamber
- suprachoroidal haemorrhage on B-scan ultrasound

Secondary repair: key steps in surgery

To prevent the catastrophic complications of delayed intervention, I advocate booking patients for posterior vitrectomy (PPV) seven days after primary repair. This timeline allows for adequate wound healing, while also minimizing the risk of complications like fibrovascular proliferation or PVR.

1. Ensure a secure primary repair. If there is any doubt about the adequacy of the initial repair, re-exploration and additional suturing are essential.

2. Front-to-back surgical approach:

Cornea: Achieving a sufficient view is usually possible, even in the presence of corneal oedema, allowing vitrectomy to proceed. Various techniques can help improve visualization, including removing the corneal epithelium, filling the anterior chamber with viscoelastic to avoid water influx into corneal stroma, and clearing fibrin or blood from the anterior chamber. Avoiding both excessively high and low intraocular pressures is also important, as is minimizing exposure to potentially toxic drops in the preoperative period. If visualization remains inadequate despite these measures, a temporary keratoprosthesis may be considered. However, this is not available in low-income settings and is one of our contraindications for surgery when required.

Iris: Preparation of the iris diaphragm is crucial, especially for eyes requiring silicone oil tamponade. I often use McCannel sutures or Siepser's knots to repair iris defects. A peripheral iridectomy may also be necessary in aphakic eyes to prevent pupillary block.

A silicone oil retention suture is indispensable in cases where iris is completely missing. There are a few important points to remember about this technique: First and foremost, you need a functioning ciliary body to keep silicone oil at the back of the eye as it fills the AC with aqueous humour. Properly sealing all anterior segment wounds is vital to prevent oil migration during or after surgery, as any drop in the anterior chamber pressure towards the end of surgery is likely to cause oil to migrate to the anterior chamber and will not go back.

Lens and capsule: Complete removal of the lens, including the capsule, is of paramount importance. A good tip for this: I use bimanual technique with forceps to pull the capsule centrally and stretch the zonules, then use a vitreous cutter to sever the connection to the ciliary processes. This is particularly important in young patients, where traction from pulling zonules can lead to retinal tears.

Ciliary body: Clearing fibrin, blood, or vitreous from the ciliary processes is essential to prevent chronic inflammation and traction. Perform scleral indentation to ensure that the ciliary processes are free of any residual capsule.

Suprachoroidal hemorrhage: If detected on B-scan, I prefer draining it before initiating vitrectomy

3. Vitrectomy setup and execution:

23-gauge, four-port pars plana vitrectomy (PPV) with a chandelier illumination system.

I usually start with an anterior chamber maintainer, even in phakic eyes, as it is usually difficult to see the position of the infusion cannula at the start of the case.

Start vitrectomy slightly superonasally, to avoid cutting into the temporal retina, where the macula is located. Carefully identify the retina to prevent inadvertent injury. Patience is critical in making the first opening in the posterior hyaloid, until I clear the view to proceed further.

Triamcinolone staining helps visualize residual vitreous. I induce posterior vitreous detachment (PVD) as needed and ensure its complete removal. In my experience, this is done easily in the majority of cases.

I perform a bimanual peripheral vitrectomy using the chandelier system-clearing peripheral vitreous with base shaving and ensuring ciliary processes are free.

Generally speaking, these patients will usually have multiple oral breaks. I usually end up doing 360-degree laser retinopexy. I have a very low threshold of using silicone oil as a tamponade.

Managing large intraocular foreign bodies (IOFBs)

In Africa, large IOFBs are unfortunately common, meaning that conventional techniques often fall short. I once encountered a large stone inside the eye, which I successfully removed using a prolene suture loop with a sliding knot. A large scleral wound, similar to the incision for manual small-incision cataract surgery, is ideal for such cases, as it allows atraumatic removal and is self-sealing.

Retinal incarceration near IOFB sites is best left alone if the macula is unaffected and the retina is otherwise attached.

Certain cases are best left unoperated to avoid accelerating phthisis or causing unnecessary pain in patients. These include situations requiring temporary keratoprostheses, failed multiple surgeries, or chronic closed-funnel detachments of long duration.

Conclusion

The primary repair of open globe injuries is just the beginning. Ensuring meticulous primary repair, removing the lens entirely, and performing early pars plana vitrectomy can significantly improve outcomes and reduce the risk of enucleation. These interventions provide hope for patients facing otherwise devastating prognoses, and underscore the critical role of early pars plana vitrectomy in managing complex ocular trauma.

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See references online at: theophthalmologist.com

ANTERIOR SEGMENT

Towards a Functional Classification of Intraocular Lenses

A standardized way to evaluate IOLs based on clinical outcomes that matter to patients

The increasing variety of intraocular lenses (IOLs) has made it imperative to define clear, evidence-based classification criteria. Historically, IOLs were often classified by optical principles or physical structures, but these lacked a direct correlation with real-world functional outcomes, such as the visual acuity experienced across the Depth of field (DoF) or Range of field (RoF). This inconsistency led to confusion among ophthalmologists and surgeons when comparing technologies and choosing the most suitable lenses for patients. Functional classification, therefore, bridges this gap, offering a standardized way to evaluate IOLs based on clinical outcomes that matter to patients, such as visual and patient reported outcomes.

How was the functional classification developed?

The creation of the new classification is grounded in rigorous scientific methodology (1). A scoping review of existing studies identified key visual performance metrics. Cluster analysis of the data revealed patterns that allowed IOLs to be categorized based on their functional outcomes. Specifically, two variables for defining cut-offs emerged from the monocular distance-corrected defocus curve:

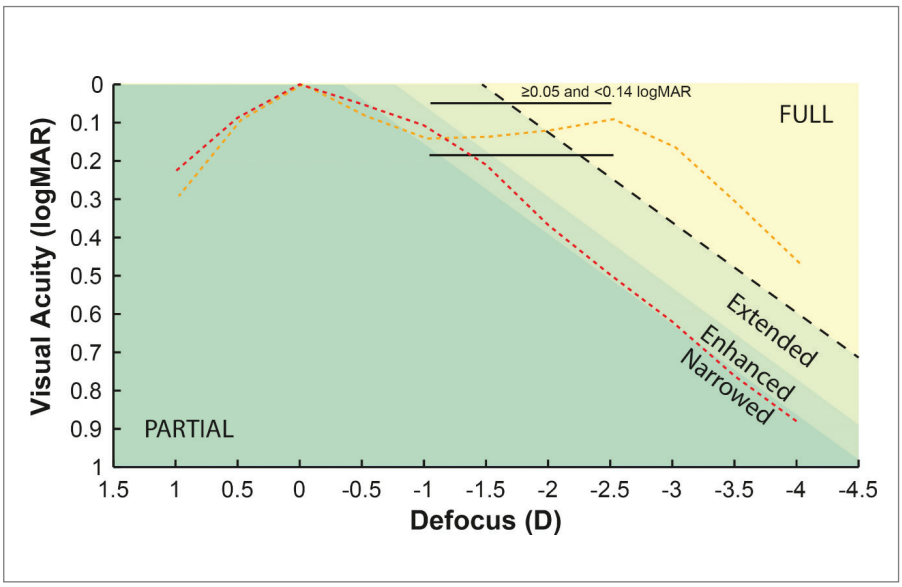

Figure 1. Schematic example for classifying functional performance based on the monocular distance corrected defocus curve

- The RoF achieved, measured at specific visual acuity cut-offs of 0.2 and 0.3 logMAR.
- The visual acuity improvement (ΔVA) between intermediate and near vision.

By relying on defocus curves and statistical techniques, the classification was developed to reflect evidence-based cut-offs.

Functional classification categories

The functional classification introduces six categories of IOL performance based on the RoF and ΔVA cut-offs detailed in Table 1.

How to classify the performance of an IOL based on the defocus curve

Although the table might be difficult to digest for clinicians unfamiliar with the defocus curve, it is straightforward to classify the performance of an IOL in two steps for partial RoF and three steps for Full RoF IOLs:

- Step 1: Normalize the defocus curve to allow comparisons between studies. This involves adjusting the curve upward or downward so that the far-distance peak aligns at 0D and 0 logMAR. This normalization is essential to minimize bias caused by differences in sample age or testing conditions across studies.
- Step 2: Identify the achieved RoF. In Figure 1, colored backgrounds delineate areas based on the cut-offs specified in the table. A dashed line separates the two main categories: Partial RoF and Full RoF.
- Step 3: For Full RoF IOLs, determine the visual acuity difference between the minimum at intermediate distance and the maximum at near distance.

In Figure 1, two monocular distance-corrected defocus curves are illustrated. After Step 1, both curves align at 0 logMAR and 0D. In Step 2, the red curve is identified as a Partial RoF IOL within the Enhanced range, leading to its classification as PARTIAL-RoF Enhanced. For the orange curve,

	RoF for 0.20 logMAR (Diopters, D)	RoF for 0.30 logMAR (Diopters, D)	DVA (logMAR)
1. PARTIAL-RoF	< 2.3	< 2.75	0
1.1. Narrowed	< 1.2	< 1.61	0
1.2. Enhanced	≥1.2 and <1.58	≥1.61 and <1.98	0
1.3. Extended	≥1.58 and <2.3	≥1.98 and <2.75	0
2. FULL-RoF	≥ 2.3	≥ 2.75	≥ 0
2.1 Continuous	≥ 2.3	≥ 2.75	< 0.05
2.2 Smooth	≥ 2.3	≥ 2.75	≥0.05 and <0.14
2.3 Steep	≥ 2.3	≥ 2.75	≥ 0.14

RoF = range of the depth of field from CDVA with visual acuity ≤ 0.20 or 0.30 logMAR at some defocus data point; ΔVA = visual acuity increase from intermediate to near

Table 1. The functional classification of intraocular lenses

Step 2 identifies it as a Full RoF IOL. Proceeding to Step 3, the visual acuity difference between intermediate and near points exceeds 0.05 logMAR but remains below 0.14 logMAR. According to the table, this performance is classified as FULL-RoF Smooth.

"Historically, IOLs were often classified by optical principles or physical structures, but these lacked a direct correlation with real-world functional outcomes..."

Which organizations support the functional classification and what's next?

The functional classification was proposed as a future line of work from the ESCRS Functional Vision Working Group (2). This classification does not replace the current international standards, but provides further evidence to the cut-offs already included in the ISO 11979-7:2024 and the ANSI guidelines (3,4). It represents a complement that introduces, based on evidence, IOL performances that are not differentiated in the current standards and allow the surgeon to have a better understanding based on clinical outcomes.

Future plans aim to address current limitations, particularly the omission of significant functional outcomes like dysphotopsia. As clinical studies improve their reporting quality, outcomes such as patient-reported experiences may be integrated into an updated classification system. In addition, although the cut-offs have been derived from scientific method and not from opinions, the terminology used for referring to each one of the six categories is based on the authors' academic knowledge. This subjectivity may result in a nomenclature that, in certain contexts, could benefit from better adaptation to socio-cultural particularities. At ESCRS, we are committed to the pursuit of consensus among the three key stakeholders: scientific societies, regulators (ISO), and the industry.

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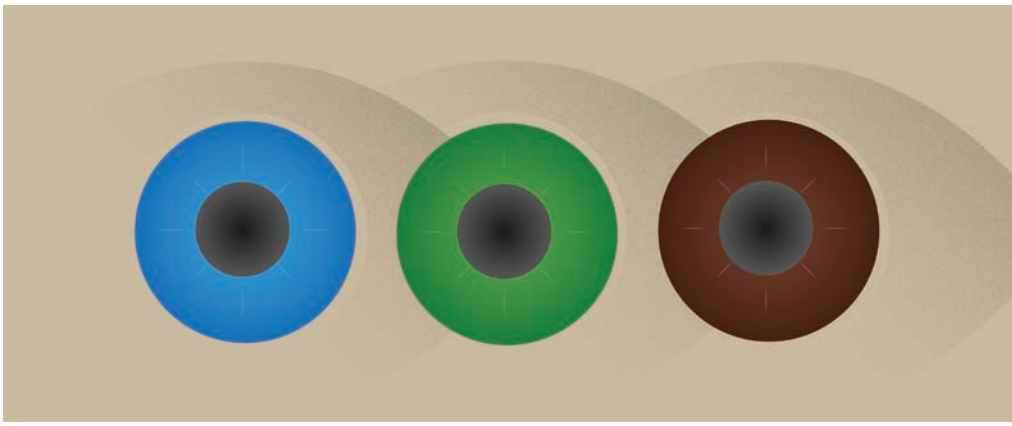
GLAUCOMA

How Cornea Surgeons Can Expand Access to Interventional Glaucoma Treatment

By Caroline Watson, cataract, refractive, and cornea surgeon at Alabama Vision Center.
Disclosures: Caroline Watson is a paid consultant of Sight Sciences.



Glaucoma eye drops present a significant challenge for patient compliance. They often irritate the ocular surface, and they are prescribed to patients who may have limited dexterity and face the burden of a lifelong daily regimen. Compounding the issue, glaucoma is asymptomatic until vision loss occurs, providing no immediate incentive for patients to remain consistent with their treatment. Unsurprisingly, only about 40 percent of patients adhere to their prescribed therapy, leaving the remaining 60 percent at increased risk of vision loss (1).

Interventional glaucoma offers a far more practical solution for these patients. It enables surgeons to manage glaucoma proactively by addressing the disease directly and earlier rather than relying on patients to adhere to a burdensome at-home therapy regimen.

As a cataract and refractive surgeon who also manages ocular surface disease (OSD), I have expanded my interventional treatment options for glaucoma to ensure my patients receive the highest standard of care. Additionally, I am addressing an unmet need in my community by accepting referrals for mild to moderate glaucoma – an easy integration into my practice using three reliable modalities. As I continue to encounter patients with eye drop-induced OSD and poorly controlled intraocular pressure, I hope more of my colleagues will adopt this approach, making interventional glaucoma therapy more widely accessible.

A patient-driven approach to glaucoma

For cataract surgeons, minimally-invasive glaucoma surgery (MIGS) is indispensable – when we are already in the eye, it's a unique opportunity to address both cataracts and glaucoma in a single surgery with one recovery period. It is our responsibility to help patients achieve better glaucoma control while restoring clear vision. In my practice around half of my cataract/glaucoma patients are referred for both procedures, while the other half come in for cataract surgery alone. I make it a priority to educate referring practitioners about interventional options that can help their patients – whether or not they have cataracts – to reduce or eliminate their reliance on eye drops.

As a cornea surgeon, I also encounter a significant amount of preoperative OSD. Over time, our practice has developed specialized expertise in managing OSD. This has become a major entry point for glaucoma patients, many of whom have been on one or two glaucoma drops for years and now suffer from severe OSD. These patients often have no symptoms of glaucoma itself, but the side effects of their medications wreak havoc on their ocular surface and test their commitment to treatment. In such cases, we take a step back, introducing interventional treatments to reduce or eliminate their dependency on drops, and giving their ocular surface a much-needed break.

For anterior segment surgeons already skilled in angle-based surgery, MIGS are relatively straightforward. To better serve OSD patients with glaucoma, I expanded my treatment options to include more standalone MIGS procedures – performed independently of cataract surgery and suitable for both phakic and pseudophakic patients. This decision was reinforced when I attended an interventional glaucoma course and heard six distinguished glaucoma surgeons present six different (yet equally effective) approaches highlighting the versatility of interventional care. It showed that we can confidently select effective, patient-centered options tailored to our skills and preferences – just as we do when personalizing refractive cataract surgery.

Patient education is also crucial. Cataract and OSD patients often don't anticipate a recommendation for a glaucoma procedure and so they naturally have questions. I take the time to explain that glaucoma is a progressive condition, and early intervention significantly reduces the risk of vision loss. Unlike eye drops, these interventional options don't contribute to OSD, nor do they rely on patient adherence. I also reassure them that if their glaucoma progresses in the future, additional treatment options are available. In nearly all cases, patients quickly understand the benefits and agree to proceed with the recommended treatment.

My three reliable modalities

Since embracing an interventional approach to glaucoma treatment, I now rarely prescribe glaucoma drops – using them only to manage occasional pressure spikes or as a temporary measure before surgery. Interventional therapies allow me to manage glaucoma without burdening the patient, and integrating them into our practice has been a very smooth process. My three preferred modalities aren't first, second, and third steps, but rather a toolbox of options available to meet patients' varying needs and situations.

1. **Selective laser trabeculoplasty (SLT).** For a long time, eye drop medications were the only first-line glaucoma therapy. However, SLT has emerged as a proven alternative, demonstrated in multiple studies to be more effective than drop therapy while causing fewer side effects. This shift has positioned SLT more frequently as a first-line therapy option. My preference for SLT stems from wanting to improve the ocular surface and remove adherence as a barrier to managing this disease.
2. **Extended-release medication implants.** Extended-release medication implants are an innovative solution for managing glaucoma, offering reliable intraocular pressure (IOP) reduction while eliminating the burden of daily self-administered treatments and the associated risks of poor adherence and OSD. Bimatoprost SR (Durysta, Allergan) is a biodegradable implant designed to provide sustained IOP reduction for several months. It's injected directly into the anterior chamber during a simple in-office procedure at the slit lamp. Travoprost (iDose TR, Glaukos) is a tiny titanium implant preloaded with medication. Anchored to the scleral tissue, it provides consistent drug delivery for well over a year. Unlike Durysta, the iDose TR requires placement in the operating room, making it a longer-lasting option for sustained glaucoma management. Both options exemplify the potential of extended-release therapies to improve outcomes and simplify care for patients with glaucoma.
3. **MIGS surgery.** With the wide variety of MIGS devices available, it's important to focus on options that work seamlessly in practice. For me, the ideal MIGS is one that feels intuitive, delivers consistent clinical outcomes, and is versatile enough to be used alongside cataract surgery or as a standalone procedure. I frequently perform the OMNI procedure (Sight Sciences), which combines canaloplasty followed by trabeculotomy. This procedure stands out because it leaves no implant behind, while addressing three areas of resistance: Schlemm's canal, collector channels, and the trabecular meshwork. This makes it an effective option for managing primary open-angle glaucoma across its entire spectrum, from mild to advanced stages. Additionally, the OMNI procedure has demonstrated excellent outcomes in lowering IOP and reducing the need for medications (2).
   - For Full RoF IOLs, determine the visual acuity difference between the minimum at intermediate distance and the maximum at near distance.

The flexibility of these treatment options is invaluable. For patients with well-controlled pressure on a single medication but with significant ocular surface damage, I often opt for SLT or an implant, either of which can typically replace one drop. I also frequently perform standalone MIGS, particularly with OMNI, which is highly effective for OSD patients taking two or more medications. This is also my go-to for post-cataract glaucoma patients with OSD, as it alleviates the burden of eye drops and provides much-needed relief for the ocular surface.

Many patients with both cataracts and glaucoma suffer from severe OSD; it is essential to reset the treatment algorithm to address both conditions simultaneously. Beyond standard bilateral cataract surgery, MIGS offers the flexibility to individualize care based on diagnostic findings. For instance, if one eye demonstrates visual field defects or optic nerve changes while the other does not, I can perform OMNI on the affected eye, treat the other with SLT, and continue monitoring its progress. This tailored approach ensures both problems are managed effectively, improving outcomes and quality of life for my patients.

Helping to expand access

Expanding access to interventional glaucoma therapies is a critical step in transforming how we care for patients with glaucoma. By integrating advanced modalities like SLT, extended-release medication implants, and a MIGS procedure with OMNI into our routine practice, we can reduce the reliance on patient adherence to medications and improve both ocular health and quality of life. These approaches empower anterior segment surgeons to address glaucoma effectively while minimizing the burden of long-term therapy, especially for patients with OSD.

For practitioners, embracing these options also broadens the scope of care, meeting a growing need in the community for comprehensive glaucoma management. As we shift towards patient-driven, interventional care, we have the opportunity to make a profound impact on the lives of those affected by this sight-threatening disease.

See references online at: theophthalmologist.com

RETINA

Practice Tips for Young Retina Specialists

Strategies for managing that scarcest of all resources – time – to keep your retina practice on the cutting-edge

As a medical student at Jefferson University in Philadelphia, I wasn't expecting to become a retina specialist. That all changed for me during the retina training in my ophthalmology rotation, when I saw just how scared and vulnerable these patients are and how incredibly vital vision is to people's lives. I realized that, as a retina specialist, I would be in a position to truly make their lives better. It's hard to overstate how central vision is to all of our lives. One report found that patients with advanced age-related macular degeneration (AMD) said that they would trade an average of 60 percent of their remaining life expectancy to return to normal vision (1).Retina practices are increasingly busy, as we are fortunate to have not only standard-of-care anti-VEGF treatments with ever-improving durability and promising new agents in FDA clinical trials, but also, for the first time, approved treatments for our geographic atrophy (GA) patients too. However, in this fast-paced environment, it is easy to get caught on a hamster wheel of going from room to room, looking for fluid on OCT to decide whether or not to inject, instead of refining our techniques and treatment approach.

As a specialty, it is critical that we stay up to date on imaging advances and nuanced findings as this is what helps to prognosticate our patients and guide our treatments. OCT might show disorganization of the retinal inner layers (DRIL), for example, that can explain poor vision (Figure 1). Sun et al were the first to define DRIL and demonstrate a correlation between it and visual acuity in patients with diabetic macular edema, and its presence has been reported in various other retinal pathologies (2).

Figure 1. OCT of DRIL. Image courtesy of the author.

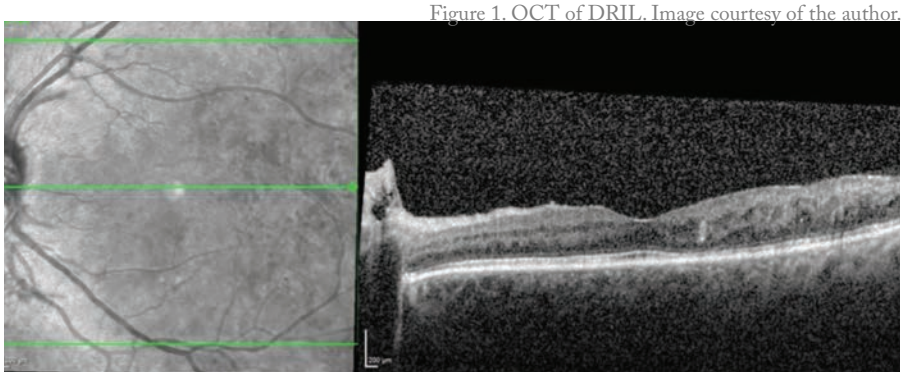
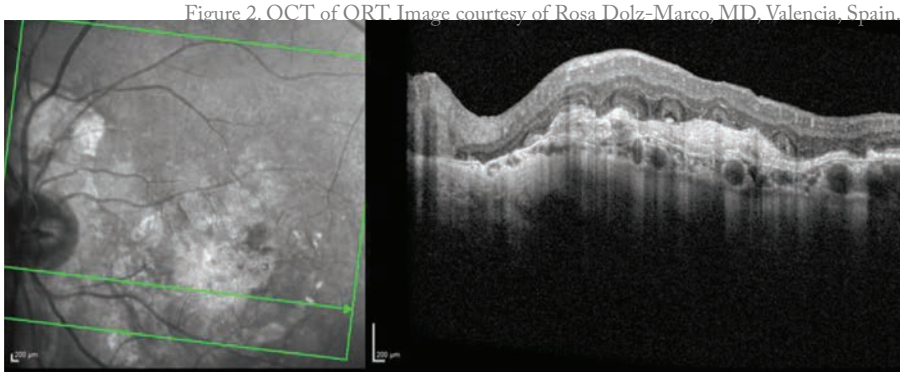


Figure 2. OCT of ORT. Image courtesy of Rosa Dolz-Marco, MD, Valencia, Spain.



Outer retinal tubulation or ORT is a feature of photoreceptor rearrangement that can be a marker for disease progression (Figure 2). ORT is seen in a variety of degenerative retinal disorders, most commonly neovascular AMD (3). Their presence indicates disorganized outer retinal layers, irreversible photoreceptor damage, and a worse visual prognosis. We are still learning how other features, such as banded and stippling patterns, relate to faster progression (Figure 3).

Commit to learning

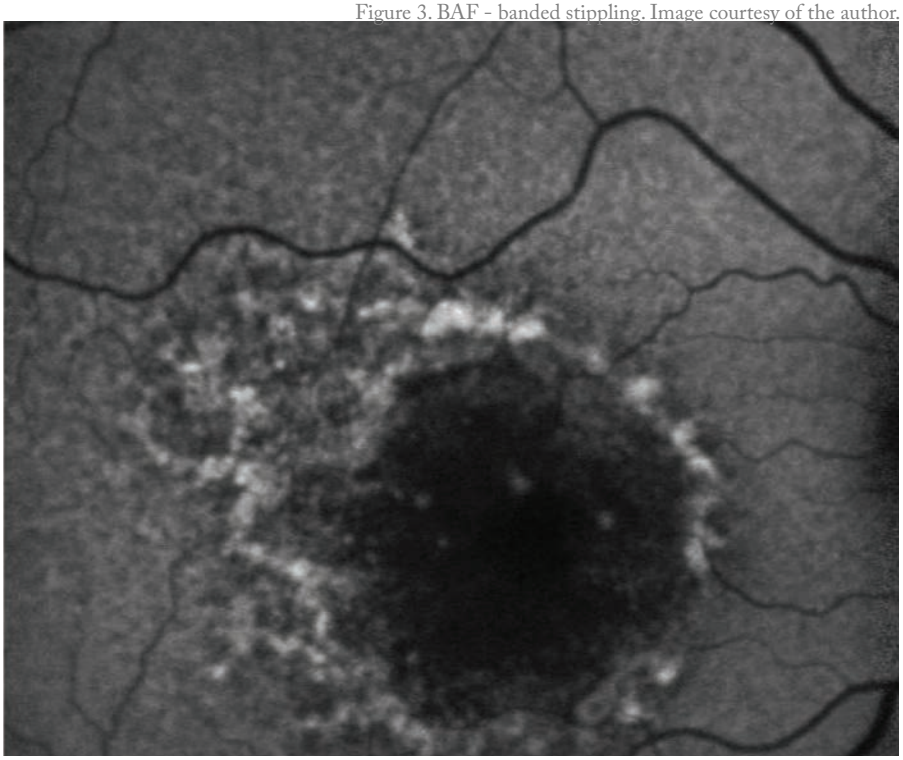
The better that we are as a community at identifying signs of retinal disease earlier, the more effective we can be with targeted treatment. This requires a concentrated effort trying to stay on top of literature and research to understand where the field is headed. For example, there is an effort to move away from saying "choroidal neovascularization," and instead referring to type 1, type 2, or type 3 macular neovascularization, as a way to help determine how aggressive we are with treatments (4). The more up to date we are, the better the care we can provide to patients.

Making time for education requires planning and prioritization. I like to listen to podcasts in the car and watch videos in my office on a break or during downtime in the OR. In eye care, there are a wide variety of options for getting information both online and by attending meetings in person. I find roundtable discussions to be particularly engaging, and I also like to run cases by my partners. Having that collaboration and exchange of ideas is a great way to stay on top of practice patterns.

Make your time count

As alluded to earlier, the biggest challenge we all have is time. I often say if I could have a superpower, it would be to control time. Sadly, I cannot control time, but I can optimize the time I do have. One way I do this is to make patients feel as if I

Figure 3. BAF - banded stippling. Image courtesy of the author.



have connected with them even if I am not giving them a lot of time. It might be as simple as putting a note in their chart about their children or pets and asking about them by name at follow-up visits. This small exchange makes patients feel like you know them and care about them.

Making sure to connect on a personal level with my patients also helps me stay engaged. It can be a challenge to be present with patients when you are going into the room, injecting them, and then quickly leaving for the next appointment. My patients are important to me, so I want them to feel that way.

Retina patients are "high touch" and require a lot of time for education – GA patients in particular. Often I will send them home with information and have them come back with their family. If I have to continue a conversation, I may call them on my commute home. For me, that's additional time that I can give to go over their questions or allay their concerns.

Outsource what you can

Outsourcing as many responsibilities as you feel comfortable with is a key way to handle time constraints and high volume. My staff, for example, talks to patients about treatment options, gives them the post-injection instructions, and makes sure they are using appropriate artificial tears.

Having staff that you trust and who are all working toward the same goal is a cornerstone of our ability to instill confidence in our patients. If you take good care of your patients and they are happy, your staff is also happy. My staff feel like they are making a contribution. For example, when patients come back from a retinal detachment repair and they are doing great, they want to express their thanks to the staff for helping them with the process of getting to the OR, and our staff appreciates that engagement.

Technology for efficiency

When going from room to room, studying OCTs looking for fluid, we may need a reminder as to what exactly has been going on with each patient. I use the Heidelberg Engineering SPECTRALIS OCT, which has a Progression Report feature that allows me to preview or print all of a patient's past OCTs. I can quickly understand their fluid over the past six months, for example, without having to wait for each individual image to load. I can have my staff tee it up for me when I walk in. That has been really helpful for me to decide therapeutic strategy.

Along with OCT, EMR is essential for helping us track disease over time and contributes to day-to-day efficiency. Backend workflows assist in managing things like drug inventory and prior authorization which have helped our staff streamline their workflow. They can plan for the week ahead and ensure we are as prepared as possible.

Keeping it real at home

For all of us, this notion of work-life balance is something we strive to achieve in a way that works for each of us. I have two small kids, so for me, some days are better than others! Some days, I am able to go home and just spend quality time with them, and on others, I'm pulled in competing directions. It doesn't always work perfectly, but when I am with them, I put my phone away to just be with them. Ultimately, nothing is more important than our mental health and our families.

Someone once told me that your kids will never remember that great talk you gave or that extra patient you saw or that complex surgery you did. But they are going to remember if you showed up to their baseball game. That thought really resonated with me, so I try to stay present for them. It's not easy, but we cannot hesitate to prioritize the things that are important in our lives, including ourselves.

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See references online at: theophthalmologist.com


"I just went outside of my comfort zone and applied for a big grant for a molecular study of meningiomas..."

Mentorship, Motherhood, and Molecular Science

Sitting Down With… Andrea Tooley, Associate Professor of Oculoplastic and Orbital Surgery and Ophthalmology Residency Program Director at Mayo Clinic, Rochester, Minnesota, USA

When you featured in our Rising Stars feature back in 2017, you were completing your residency at Mayo Clinic. How has your career evolved since then?
As I was wrapping up my residency I decided to do the American Society of Ophthalmic Plastic and Reconstructive Surgery fellowship in New York. This is a multi-institutional fellowship that allows you to spend time at Weill Cornell, Columbia University, New York University, and Manhattan Ear, Eye, and Throat Hospital. I was under the mentorship of two phenomenal oculoplastic surgeons, Michael Kazim and Richard Lisman. It was the most wonderful fellowship ever.

As a Mayo Foundation Scholar I was then able to come back to Mayo Clinic full-time on faculty in 2020. That was an easy decision because Mayo is phenomenal, but there was also an opportunity for me to be involved in resident education. During my time as a resident, I realized I was really interested in education and curriculum development and those kinds of things. The Mayo Program Director Andy Barkmeier was approaching the end of his term and looking for someone to pass the torch to. So it was perfect timing for me; I took over the Associate Program Director role for the residency. Then in 2023, I became the Residency Program Director, and it's been terrific.

I'm also really involved with the American Academy of Ophthalmology (AAO). Back when I was a resident I was one of the few ophthalmologists on social media. That allowed me to get involved with the AAO's YO Committee; there were other young ophthalmologists on social media and it was a good avenue to connect with them. I loved being able to share resources with people who were in my shoes – residents and ophthalmologists just starting their careers. I eventually took over as chair of the committee from Janice Law, who's an incredible educator and mentor and has taught me so much. This is my third year as the chair; I've loved leading the committee, helping more students get involved, and bringing in more international students. It's been great fun to connect with young ophthalmologists across the globe.

How has your use of social media changed over the years?
When I was a student and there wasn't much social media, medicine was such a black box – you couldn't find good information about what life was like as a medical student or a resident. My whole mission was to inspire young people to choose a career in medicine. But now there are thousands of medical students on YouTube making great content so people can see exactly what life is like as a medical student.

As I progressed through my career, my goals changed and I found myself doing much less YouTube because I didn't have the time to edit the videos. But I'm still very active on Instagram. I post almost every day and I still have the same goals about sharing experiences and resources. And I added a new spin when I started having kids. I just had my third child and it's been fun to showcase what life is like as a mom who is passionate about her career, who wants to be a great surgeon and a great mom! I didn't have a lot of female mentors that said, "Hey, you can be a mom and be a surgeon and this is how you do it." So that's something I'm trying to do.

In 2017, we talked about your interest in philanthropic ophthalmology. Is this still something you're involved with?
The whole reason I chose ophthalmology was because I was able to work with Orbis as a very young student. But I found as I transitioned to residency and fellowship that it gets hard to focus on international or philanthropic interests, besides just doing local vision screenings and local outreach clinics. It's easy for all that to get placed on the back burner as you go through the rigors of training.

As I've gotten into more of an attending role, however, I am feeling that call to expand my international work again. I went to the Global Ophthalmology Summit last year and we've started a new global health track at Mayo looking at health equities and offering a great experience for residents to learn about global ophthalmology. I think the philanthropic aspect of ophthalmology is a strong motivation for people in the profession – what is better than going somewhere without a lot of resources and being able to improve patients' sight and improve their quality of life?

What would you like to achieve in the next 8-10 years?
What I love about ophthalmology is that it's possible to be multifaceted and that keeps me energized and engaged and it fills my cup. I love having lots of different aspects to my work. I am enjoying being Residency Program Director – there's lots of new curriculum development I want to work on for our residency program – and I'm still very passionate about my work with AAO. As I mentioned I want to advance again with my global philanthropic work, and also I want to add more of a basic science spin to my career. I've done lots of clinical research, but I just went outside of my comfort zone and applied for a big grant for a molecular study of meningiomas, which is a passion of mine. I see a lot of patients with very bad meningiomas and we have no good treatment options for them. I'm working with a team of incredible scientists at Mayo who are helping us do molecular work, so that we can hopefully develop some targeted therapies for meningioma. Expanding my research and adding some basic science is something I'm super excited about for the next five to 10 years. I think that will be a big focus for me.

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