MARCH 2018 # 19

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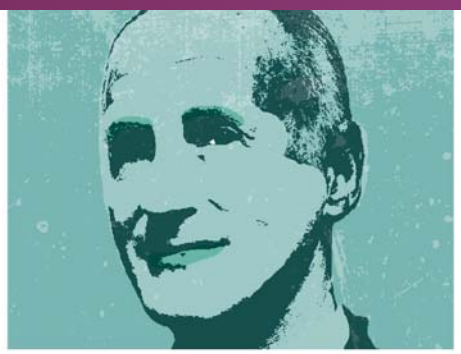

Confessions of a Live Surgeon

The intriguing world of live surgery, as told by those who know it best




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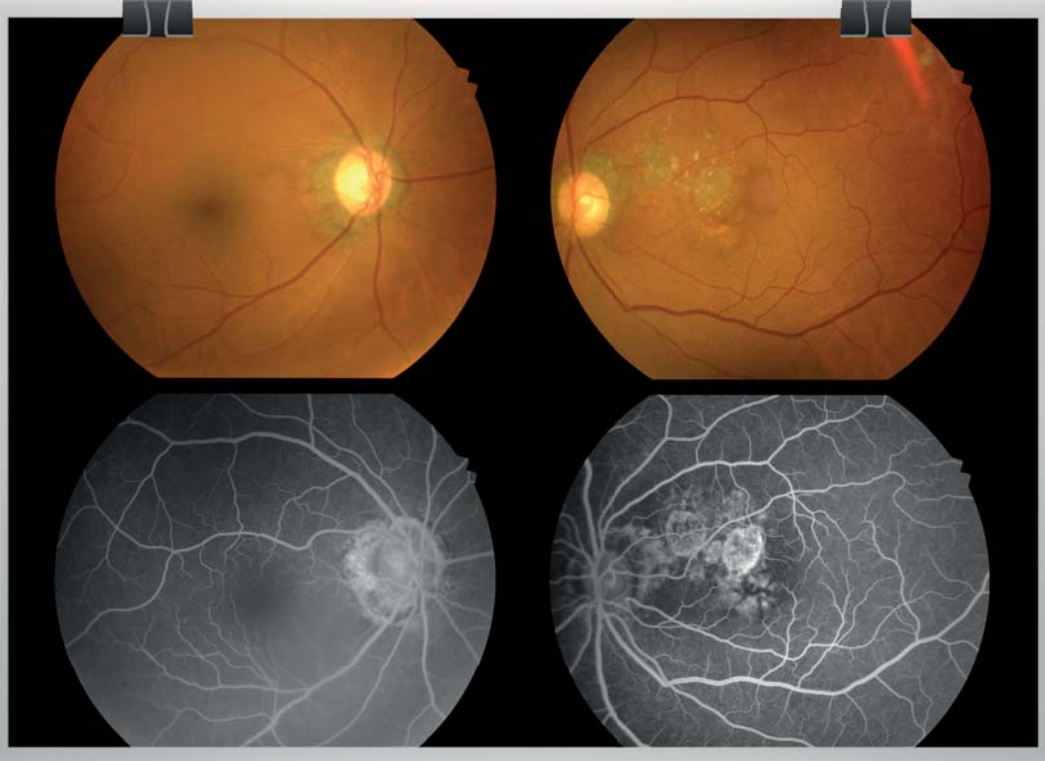

An Eye on Gout

Fundus photographs (top) and a fluorescein angiogram (bottom) obtained from a 62-year old male patient with poorly controlled gout, demonstrating highly refractile, crystal-like lesions. As the first evidence of refractive macular lesions in a patient with gout, the case report authors suggest that patients with gout and visual complications should receive careful examination of both the posterior and anterior segment (Y Jiang et al., BMC Ophthalmol, 18, 11 (2018). PMID: 29351793).

Credit: Y Jiang, JE Brenner and WJ Foster.

Do you have an image you'd like to see featured in The Ophthalmologist?
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On The Cover

The Warhol-esque cover this month features four live surgery veterans, and illustrations of what they've gone through to present – from international travel to an unfortunate encounter with cobra bile...

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1. Alcon Data on File (Jul 2016). 2. AcrySof® IQ ReSTOR® +2.5 D Multifocal Toric IOL Directions for Use. 3. Vega F, Alba-Bueno F, Millán MS, Varon C, Gil MA, Buil JA. Halo and through-focus performance of four diffractive multifocal intraocular lenses. *Invest Ophthalmol Vis Sci*. 2015;56(6):3967-3975 (study conducted with corneal model eye with 0.28µ spherical aberration). 4. Wirtitsch MG, Findl O, Menapace R, et al. Effect of haptic design on change in axial lens position after cataract surgery. *J Cataract Refract Surg*. 2004;30(1):45-51 5. Visser N, Bauer NJ, Nuijts RM. Toric intraocular lenses: historical overview, patient selection, IOL calculation, surgical techniques, clinical outcomes, and complications. *J Cataract Refract Surg*. 2013;39(4):624-637. 6. Potvin R, Kramer BA, Hardten DR, Berdahl JP. Toric intraocular lens orientation and residual refractive astigmatism: an analysis. *Clin Ophthalmol*. 2016;10;1829-1836.

NextGen

Profession

Sitting Down With

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hayley.atiz@texerepublishing.com
Hayley Atiz, The Ophthalmologist,
Texere Publishing Ltd, Haig House, Haig Road,
Knutsford, Cheshire, WA16 8DX, UK

General enquiries
www.texerepublishing.com
info@texerepublishing.com
+44 (0) 1565 745 200
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Generally Regarded as Safe

A saccharine story of the more you learn, the less you know

I'm a child of the 1980s and, when I think about it, people were thinner back then. So it's quite odd that it was also the decade in which 'diet' carbonated drinks came to market and Spandex-clad aerobics instructors started to yell at us to move our bodies on breakfast TV. Did we need to be even thinner and healthier? In any case, why are we not all gods and goddesses in human form today?!

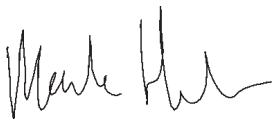
Something else happened in 1981. After extensive study, the FDA approved aspartame and acesulfame potassium as 'generally regarded as safe' food additives. In short, food and drink manufacturers can use the ingredients, and the public should be fine to consume them.

Here's the thing. On average, we developed-nation dwellers consume fewer calories than 30–40 years ago. But we're bigger and more likely to be diabetic than in the past. And now, we read that aspartame consumption is associated with increased HbA1c, hunger – and that the rates of proliferative diabetic retinopathy (PDR) soar as diet soda consumption increases (1) – see page 10.

There are a number of potential explanations. Perhaps those who are overweight or diabetic/prediabetic choose to avoid 'full-fat' Coke and go for the Diet or Zero alternatives. Another explanation is that artificial sweeteners alter gut bacterial flora, which then affects energy metabolism (experiments have shown that you can turn a fat mouse thin – and vice versa – by changing their gut bacteria). Or perhaps after 20–30 years of near-daily consumption, ingredients 'generally regarded as safe' might not be particularly safe after all – in this case, to the retina.

But I see hope. When you're a child of the 1980s, you've also seen a number of dietary fads come and go: fat is bad, fat is good; carbs are good, carbs are bad; monounsaturated fats are the Devil's work, polyunsaturated fats are so much healthier. We are still figuring out that it's far more complicated than that. And when there's solar-system's-worth of data out there, there's insight to be had. When the ferocious pace of artificial medical intelligence helps us mine the golden nuggets of what's actually good (and bad) for you, I suspect many 'old wives' tales' of fish being good for your brain, and so on, will objectively be proven right. Hopefully, we will then be able identify compounds that are generally regarded as 'safe,' sparing us from more of what it looks like we have here: a full pipeline of PDR cases waiting to happen.

Mark Hillen
Editor



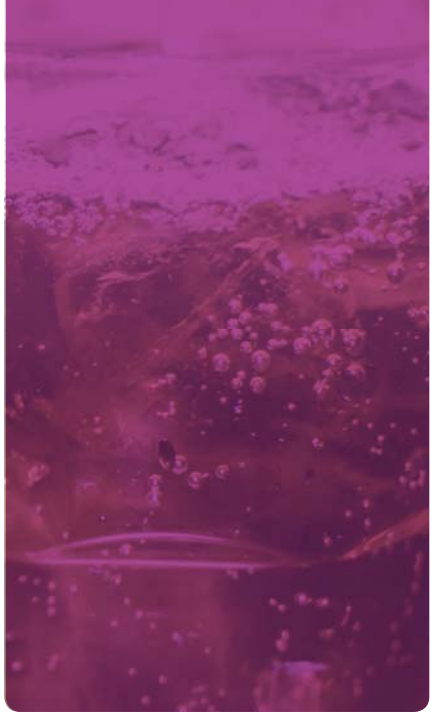
Reference

1. *EK Fenwick et al., "Diet soft drink is associated with increased odds of proliferative diabetic retinopathy", Clin Exp Ophthalmol. [Epub ahead of print] (2018). PMID: 29360260.*

Upfront

Reporting on the innovations in medicine and surgery, the research policies and personalities that shape the practice of ophthalmology.

We welcome suggestions on anything that's impactful on ophthalmology; please email edit@theophthalmologist.com



Ditch the Diet… Drinks

Research finds a link between consumption of low-calorie beverages and proliferative diabetic retinopathy

From ginger beer to cola, many people enjoy a refreshing soft drink. Obesity and tooth decay are well-known as potential risks of consuming sugary beverages, but what about their artificially-sweetened, lower-calorie cousins? Evidence is building around the theory that such drinks may not circumvent all potential health issues. And now, a team from the Singapore Eye Research Institute and Centre for Eye Research Australia has found that consumption of diet drinks may be linked with diabetic retinopathy (DR) (1). In a cohort of 609 patients with diabetes, high levels of diet soft drink consumption (over four cans per week) was independently associated with an increased likelihood of having proliferative DR (odds ratio, 2.51; 95% CI, 1.05–5.98) when compared with no consumption. Ecosse Lamoureux, senior author of the study, tells us more.

The results seem somewhat surprising...

The association of diet soft drink consumption with DR was certainly unexpected, and prospective studies are needed to confirm this cross-sectional phenomenon. We were also surprised by the differential impact that diet and regular soft drinks had on DR risk. However, as few individuals with diabetes in our sample consumed regular soft drinks, the lack of an association could be due to inadequate statistical power; this caveat was noted in our manuscript and caution is needed when interpreting our results.

What impact could your findings have?

Our findings indicate that daily consumption of low-calorie soft drinks may be associated with DR in people with diabetes. And although more research is needed, doctors could advise patients with diabetes to reduce or eliminate the consumption of diet soft drinks. Such advice could be important for individuals with existing DR to prevent disease progression to vision-threatening stages. More importantly, our results may inform future dietary management plans for individuals with no or existing DR.

Next steps?

Given the cross-sectional nature of our study, we are unable to determine causality. Therefore, we are planning to undertake a longitudinal study, using prospectively collected dietary data to determine whether diet soft drinks are indeed unhealthy substitutes for regular soft drinks in patients with diabetes, so as best to inform the clinical management guidelines for DR.

Reference

1. *EK Fenwick et al., "Diet soft drink is associated with increased odds of proliferative diabetic retinopathy", Clin Exp Ophthalmol, [Epub ahead of print], (2018). PMID: 29360260.*

More Coherent Surgery

Three-year results from the DISCOVER study

Over the last decade, intraoperative OCT has emerged as a valuable tool; not only can it provide real-time information on surgical outcomes, it can influence decision-making during the surgery. "Previous research has demonstrated the potential feasibility of intraoperative OCT when used externally to the microscope," says Justis Ehlers of Cole Eye Institute of the Cleveland Clinic, Ohio, USA. Ehlers is Principal Investigator on the DISCOVER study, which was launched to evaluate the role of microscope-integrated OCT in ophthalmic surgery.

Building OCT directly into the microscope could bring several potential advantages over a separate system, such as increased efficiency and the ability to visualize tissue-instrument interactions. In this ongoing study, three prototype microscope-integrated OCT systems are being used by Cole Eye Institute surgeons to the feasibility and potential utility – the three-year outcomes of which have just been published (1). Of 837 eyes enrolled to date (244 anterior and 593 posterior segment cases), images were acquired successfully in 820 eyes (98.0 percent; 95% CI, 96.8–98.8 percent). In 106 anterior cases (43.4 percent; 95% CI, 37.1–49.9 percent) and 173 posterior cases (29.2 percent; 95% CI, 25.5–33.0 percent) surgeons reported that the technology influenced decisions during the surgical procedure. "We were surprised by the high frequency that OCT added value and impacted surgical decision-making – something that has also been confirmed in other studies," says Ehlers.

According to the team, the three-year results demonstrate the feasibility and usefulness of microscope-integrated OCT. "I use intraoperative OCT for most of my surgeries, including macular cases, complex retinal detachments, and proliferative diabetic retinopathy," says Ehlers. "I hope this study will help guide and inform surgeons about the potential impact of using the technology." A multi-center randomized trial is apparently in the pipeline to provide critical information on comparative outcomes with intraoperative OCT. And Ehlers says that extensive work is continuing on enhancing the technology for image quality and tracking, as well as OCT-compatible instrumentation and software analysis platforms. Who knows what the surgeons of the future will be able to see as they operate.

Reference

1. *JP Ehlers et al., "The DISCOVER study 3-year results: feasibility and usefulness of microscope-integrated OCT during ophthalmic surgery", [Epub ahead of print], (2018). PMID: 29409662.*

Musical Theater

How a fine melody might make you a better surgeon

Music can be a great motivator; it's why runners listen to it as they pound the pavement and why the Rocky III training montage features the iconic "Eye of the Tiger." And according to new research, it might also improve the surgical skills of ophthalmologists.

There is a connection between music and cognitive abilities – the so-called 'Mozart effect', but how music might affect surgical skills is not well understood. "My colleague and I had always had a passion for music and played it in our operating rooms," says Ralph Kyrillos, lead author on the associated paper (1). "We'd noticed that preference to operate with music, and opinions on the effect of music on surgical skill varied widely between surgeons. When our hospital acquired an EyeSi simulator we saw an opportunity to actually measure the impact of music on microsurgery."

According to Kyrillos, the EyeSi offered a great platform to record precise parameters that could not be measured in the real clinical setting. In their prospective study, 14 ophthalmologists and 12 residents stratified by surgical skill were randomized to perform surgical tasks with or without music (Mozart's Sonata for Two Pianos in D major K.448, in case you're wondering). "Many of the participants routinely listened to music while operating, but they all had different preferences, such as rock, classical, instrumental – or even letting the patient choose – as well as whether they kept listening to music when performing a complex or delicate part of the procedure," says Kyrillos. "This made the study really fun, as everyone had a different opinion on the subject and were intrigued what the results would show!"

For the anti-tremor task, the group found no statistically significant differences in recorded parameters between the group exposed to music and the group who were not. For the capsulorhexis task, the 'total score' and 'roundness of capsulorhexis' parameters showed statistically significant improvements in the group exposed to music ($p=0.0249$ and $p=0.0367$, respectively). Subgroup analysis showed no significant differences between surgical experience or between male and female surgeons. A post-hoc analysis identified greater improvements with music in the capsulorhexis parameters 'total score' ($p=0.0015$) and 'roundness' ($p=0.0021$) for participants who hadn't used the simulator before the study.

Concluding that exposure to music does not negatively impact surgical skills, Kyrillos says they were surprised that listening to music seemed to improve certain scores. "Based on literature describing the 'Mozart effect,' we thought music might positively affect skills, but we expected any effect to be minimal and not in the most experienced surgeons who already excelled at surgery." Kyrillos says that the group actually constructed their study to determine if music had a negative impact on surgical skill: "We thought it would be more useful to find out if we needed to stop listening to music while operating."

The group studied simulated intraocular surgery, but do their results translate to the real world? "Validation in the real operating world would be hard but not impossible," says Kyrillos. "Possible ways include comparing complication rates, or filming surgeries and analyzing the videos to measure parameters similar to those recorded by the EyeSi."

For now, if you listen while you work, you can continue safe in the knowledge that it might actually have some benefit!

Reference

1. *R Kyrillos and M Caissie. "Effect of music on surgical skill during simulated intraocular surgery", Can J Ophthalmol, 52, 538–542 (2017). PMID: 29217019.*

Early Learning

The link between depleted omega-6 fatty acid levels and retinopathy of prematurity

When babies are born pre-term, the final stages of retinal development can be disrupted by the intensive oxygen therapy administered to compensate for underdeveloped lungs, leading to retinopathy of prematurity (ROP) in some cases – and potentially blindness. It's why many researchers are on a quest to determine how best to support the ongoing retinal development and avoid disease.

Knowing that long-chain polyunsaturated fatty acids (LC-PUFAs) drive brain and retinal development in the third trimester, a Swedish team from the Sahlgrenska Academy, University of Gothenburg, decided to investigate the association between circulating LC-PUFAs and ROP in extremely pre-term infants. In their study (a secondary analysis of the randomized Donna-Mega trial comparing fish and olive oil-based supplements on ROP and other morbidities, 1), the group analyzed serum lipid levels in cord and venous blood samples obtained from 78 infants born before 28 weeks gestational age (2).

And there was a clear finding: low levels of arachidonic acid were strongly associated with ROP. In the first month of life, levels of arachidonic acid (an omega-6 fatty acid) were significantly lower in infants who then had a later diagnosis of

ROP compared with those who had no ROP ($p<0.05$); at 32 weeks post-menstrual age, the fatty acid was significantly lower in infants who developed later severe ROP ($p<0.001$). Through logistic modeling, the team also identified that low arachidonic acid levels, as well as low gestational age at birth, had greater than 90 percent sensitivity for identifying ROP development.

The group hypothesize that arachidonic acid supplementation could protect against ROP development, and plan to investigate the potential in an upcoming study. The team also suggest that low levels of the fatty acid could serve as a biomarker for risk. Commenting on their findings, Chatarina Löfqvist, lead author of the study, said (3): "We believe and hope that providing children with arachidonic acid will raise the levels and reduce the amount of ROP to minimize the risk of children becoming blind."

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1. *ClinicalTrials.gov. "A fatty acids study in preventing retinopathy of prematurity: NCT02760472". Available at: http://bit.ly/DonnaMega. Accessed February 15, 2018.*
2. *CA Löfqvist et al., "Association of retinopathy of prematurity with low levels of arachidonic acid", JAMA Ophthalmol, [Epub ahead of print], (2018). PMID: 29423508.*
3. *Margareta Gustafsson Kubista. "New discovery offers hope of protecting premature babies from blindness". Available at: http://bit.ly/ROPDiscovery. Accessed: February 15, 2018.*

Dimmer and Dumber

Too much time in the dark could impact brain function

As diurnal beings, light exposure is important. As well as dictating circadian rhythm, it also impacts other processes, such as wakefulness or mood. But does it also affect brain function during tasks? Research from a team of neuroscientists suggests that insufficient exposure to bright light could impact brain structure and function. The group from Michigan State University, East Lansing, USA, studied how bright and dim light affects hippocampal function in Nile grass rats (which are diurnal, like humans) (1). Following four weeks of exposure to dim light, the rats showed cognitive and behavioral changes, including impairments in spatial memory. Furthermore, hippocampal expression of brain-derived neurotrophic factor was reduced, and there was a 30 percent decrease in dendritic connections in the hippocampus (Figure 1). Impairments in functioning and changes in hippocampal structure were reversed after four weeks exposure to bright light.

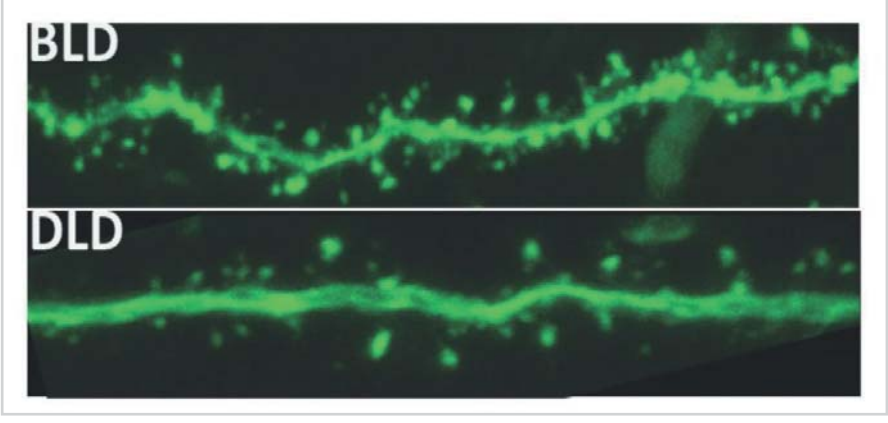

Figure 1. Nile rats exposed to dim lights (DLD) for four weeks showed a 30 percent decrease in hippocampal dendritic spine connections compared with rats exposed to bright light (BLD). Hippocampal apical dendrites were visualized by HSV-GFP expression following its injection into the dorsal hippocampus. Credit: Michigan State University.

The authors concluded that light intensity affects cognitive performance and hippocampal structural plasticity. Could these findings have implications for people with ocular diseases, such as glaucoma and retinal degeneration? An ever better question was posed by Lily Yan, the paper's corresponding author (2): "For people with eye disease, can we bypass the eye and directly manipulate this group of neurons in the brain to provide them with the same benefits of bright light exposure?" Watch this space!

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1. *JE Soler et al., "Light modulates hippocampal function and spatial learning in a diurnal rodent species: a study using male nile grass rat (Arvicanthis niloticus)", Hippocampus, [Epub ahead of print], (2017). PMID: 29251803.*
2. *Andy Henion. "Does dim light make us dumber?" MSU News. Available at: http://bit.ly/MSU-dim. Accessed: February 14, 2018.*

In My View

In this opinion section, experts from across the world share a single strongly-held view or key idea.

Submissions are welcome. Articles should be short, focused, personal and passionate, and may deal with any aspect of ophthalmology. They can be up to 600 words in length and written in the first person.

Contact the team at edit@theophthalmologist.com

One Year in...

Obamacare barely survived the first year of Trump's presidency. What will 2018 bring for ophthalmology and patients?

By Brian Joondeph, Partner and retina surgeon at Colorado Retina Associates, Denver, CO, USA

Last year was supposed to be the final year of Obamacare, at least based on promises of Candidate Donald Trump and the Republican-controlled Congress. "Repeal and Replace" was a legislative priority for the new administration. Yet Obamacare, though mortally wounded, is still alive one year into Trump's presidency. What will 2018 bring? Will Obamacare – the dying patient – heal and recover? Will it remain in a terminal state in hospice care, waiting for dying legislation? Or will Congress mercifully let Obamacare die with dignity, perhaps assisting in the process?

Congress did try; a repeal and replace bill was crafted, which, although not a true repeal, did gut the core of Obamacare. The bill passed the House but failed to pass the Senate, despite the Republican majority. A true repeal would have required 60 Senate votes to break a guaranteed Democrat filibuster. Republicans were alone in their quest with zero Democrat support, and with only a slim Senate majority, they could not even garner enough support for the replacement bill. After the failed vote, Senate Majority Leader Mitch McConnell gave up saying, "I think we'll probably move on to other issues."

"What will 2018 bring? Will Obamacare – the dying patient – heal and recover? Or will Congress mercifully let Obamacare die with dignity, perhaps assisting in the process?"

President Trump had other arrows in his quiver: executive orders. President Obama had used these effectively to circumvent the legislative process – and his successor did the same. Those who criticized Obama for taking matters into his own hands, bypassing Congress, could hardly complain when Trump did the same thing. Last fall, Trump signed several executive orders. One made it easier for individuals and small businesses to band together and buy health insurance through nationwide association health plans. A second eliminated the ban on purchasing insurance across state lines, allowing more competition and – potentially – lower prices. Another order permitted the purchase of short-term policies that didn't have to cover preexisting conditions, which allows the young and healthy to purchase 'bare bones' plans at a lower cost – better meeting their insurance needs. Lastly, the President

repealed a previous executive order providing subsidies and assistance to middle and lower income individuals for high-cost premiums and deductibles. Because the subsidies were appropriated by executive order, rather than Congress, it was much easier for the next president to simply cancel the order. Live by executive order, die by executive order.

"Ophthalmology will be affected by having to care for more Medicaid patients."

The real deathblow came via the tax bill passed late in 2017, which eliminated the individual mandate – the lynchpin of Obamacare. This went hand-in-hand with Obamacare's required coverage of preexisting conditions, forcing the young and healthy to purchase insurance – or face a penalty – to fund care for sicker patients with preexisting conditions. Whether the government can and should force individuals to purchase something they neither want nor need is up for debate, and may not be constitutional. Regardless, beginning in 2019, fewer will be paying into the system, meaning less financial support for those most in need of insurance. The downstream effect will be the continuation of an existing trend of many insurance carriers leaving the individual insurance market. Those that do stay will be charging higher premiums to offset the cost of insuring sicker and more expensive individuals.

Currently, 29 percent of Obamacare enrollees have only one insurer offering policies; in 2016, it was only 6 percent. Ten states have only one insurer. Aetna and Humana have both exited Obamacare, and Anthem has downsized its participation. Premiums also continue to rise. The benchmark silver Obamacare plan will increase 37 percent for 2018, on top of a 25 percent increase last year and a 13 percent bump the year before. This means that a healthy millennial will pay on average $5,000 per year for a silver plan, and this doesn't include the deductible and copay; here, the deductible is $4,000 and the copay is 30 percent. This is insurance that is unaffordable to purchase and just as unaffordable to actually use, which is why, without the individual mandate in place, the millennial will choose to go without insurance or else pick a low cost 'catastrophic' plan instead.

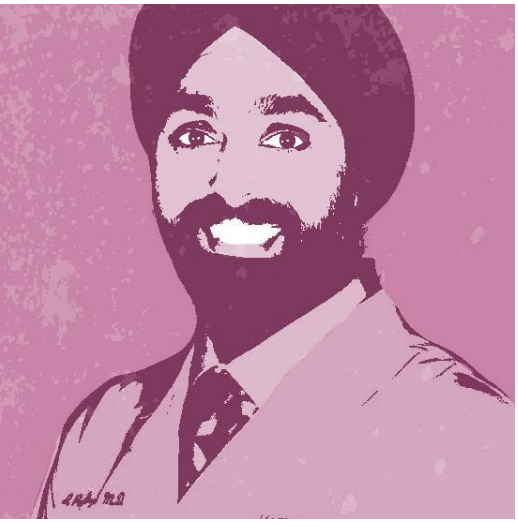
Already, fewer people are signing up for coverage in 2018 compared with the previous year. The government cut the Obamacare advertising budget by 90 percent and shortened the enrollment period. Many are choosing Medicaid insurance instead. Currently, 75 million Americans are on Medicaid, nearly a quarter of the population, and it's growing each year.

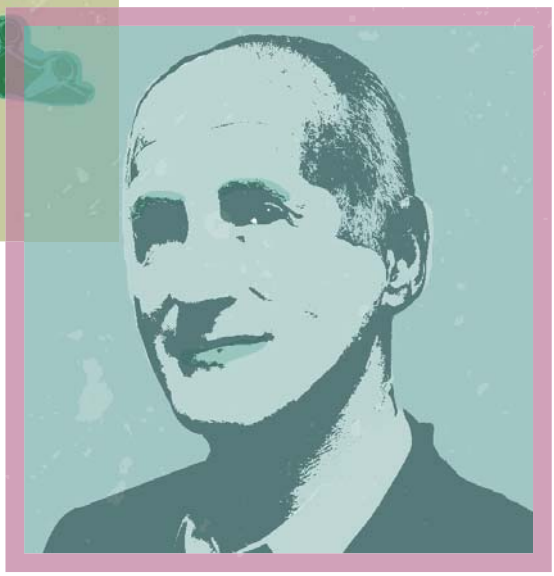
Will much change legislatively in 2018? Doubtful. It's an election year, with the November midterms determining control of Congress and the fate of President Trump. Then again, Republicans are energized after their tax victory and want to keep the ball rolling. Most likely infrastructure will be the target of their efforts rather than healthcare.

Medicare is largely unaffected by all of this, which is the primary payer in ophthalmology given the elderly patient population. Ophthalmology will, however, be affected by having to care for more Medicaid patients. Depending on the state, Medicaid reimbursement may be far below the cost of care, causing some ophthalmologists to limit or not accept any Medicaid patients. But quality measures, value-based payment schemes, and industry consolidation, outside the realm of Obamacare, will be the biggest thorn in the side of ophthalmologists. High-quality care is expensive; think of the branded drugs used to treat macular degeneration. High-cost providers will be penalized by Medicare. And add to that the growing overhead costs due to inflation and regulations. Ophthalmology practices, like many small businesses, are feeling the pinch. Reimbursements are not keeping up with the cost of doing business, leading many practices to consolidate or be purchased, as a means of staying afloat.

"Every new year brings new challenges, but we are a resourceful specialty, adapting and surviving."

Twenty-eighteen won't be the end of the world for ophthalmology in the US, but challenges will continue to apply painful pressure. True healthcare reform at a national level is unlikely based on the experiences of 2017. A slow slide toward single payer continues, with over a third of Americans receiving government-based insurance. Every year brings new challenges, but we are a resourceful specialty, adapting and surviving. Expect that to continue.







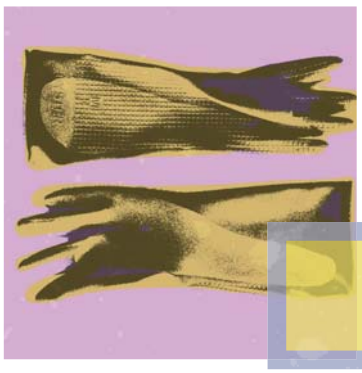

CONFESSIONS OF A LIVE SURGEON

Four leading veterans of the operating theater share their experiences – in gripping detail

By Ruth Steer

Visuals play a huge part in our learning – and it's no wonder, we're visual creatures. When it comes to pages of text or a colorful infographic, it's clear which most people would prefer. Similarly, we learn many skills through observing others. The ophthalmic surgeon is no stranger to this form of education; whether a novice or a practiced professional, observing others is a valuable learning tool. It's why live surgery is so essential.

But what is the live surgery experience actually like – and what goes into delivering it? Four veterans reflect on their encounters, share notable memories, and offer insight into secrets behind the "show." Whether you're an observer – or a performer – join us on a journey of language barriers, surprise surgery events, and even cobra bile.

NO REGRETS

Live surgery is tougher than it looks – but it is a very worthwhile experience

By Uday Devgan

Live surgery is a lot more challenging than people think. My first live surgery was back in 2003, and I was nervous – the pressure was on! So I prepared in my own private operating room in Los Angeles, giving a running commentary – either out loud or in my mind – as I was operating. I recorded all my cases, and went back afterwards to go over them and check that I wasn't making too many 'ums' or 'ahs' or stutters. Basically, I practiced. And it made a difference.

I've performed live surgeries in over a dozen countries, primarily at the large ophthalmology meetings (such as AAO, ASCRS, ESCRS, and the Asia-Pacific meetings) as part of industry showcases. What many people don't realize is that the goal of live surgery is to make it look effortless – it should look smooth and choreographed, like watching a ballet dancer. But this can actually be very difficult, as the operating room setup can be very different to the traditional operating room that people are accustomed to seeing. There can be half a dozen extra people, there'll be multiple cameras and the floor can be covered with cables. You may also have to hold your instruments slightly differently so that the camera angles aren't obscured. Another big challenge is that you might have two different earpieces whilst operating; in one ear, the director is giving you instructions, and, in the other, the moderator is talking to you and the audience. Additionally, though people mainly want to see you do well, they wouldn't mind seeing a fumble or two. But if complications arise during live surgery, you just need to stay calm and manage them as you would in your normal operating room.

LIVE LEARNING

I think there is a beautiful learning to live surgery. When sitting in a live surgery audience, I learn a lot. Even now at large meetings, I always seek out the live surgery events as I want to see them! You're seeing everything in real time – rather than edited clips – so you pick up a lot of subtleties. As surgeons, we're used to seeing through the microscope, but in live surgery, cameras can show how your hand is positioned, as well as what your feet might be doing. It's why there are meetings entirely focused on this area. One such event, organized in Italy by Roberto Bellucci, is a two-day meeting of entirely live 3D surgeries; it is a fantastic meeting and a great way to learn.

To be honest, I haven't been involved in live surgeries in the last few years; as my career advanced to running my own practice, I have found I have less time to do it. Plus, I also want to give others a chance at experiencing it! For surgeons at an earlier stage of their careers – and with more available time – it's a great way to make a name for themselves. I think live surgery is a fantastic experience and an amazing thing to do; I loved it. And I would definitely encourage skillful surgeons to get involved.

Would I go back to doing live surgeries in the future? A definite yes – if the timing and circumstances were right. For now, I am just so glad I got to experience it.

Uday Devgan is a cataract and refractive surgeon at Devgan Eye, Beverly Hills, California, USA.

Practical considerations

- Generally, patients have already had their first eye completed so they know what to expect and are more comfortable with the process on their second eye.
- If performing more than one live surgery in a day, make sure that you're operating on all the same eyes (right or left). It can be quite time consuming to switch all the cameras and angles between different patients!
- Try to choose people with lighter-colored eyes if you can. I myself have brown eyes but, in my opinion, a blue eye just works better on the screen!
- Stay calm under pressure – you have to ensure the outcome for the patient. Remember that you wouldn't be operating in front of hundreds or thousands of colleagues if you weren't at the top of your game, and that companies wouldn't select you to represent their products if you weren't the 'best of the best'.
- Don't be afraid to moderate the moderator. If you're performing the capsulorhexis and the moderator asks about IOL insertion, you can acknowledge the question but refer back to what you are actually doing. "That's a good question – let's address this later." It is much easier to talk about what you are actually doing.
- Likewise, if moderating a live surgery event, stay on the same page as the surgeon – it is difficult for them to be doing one thing and talking about something entirely different.
- Practicing before the event can be really helpful. Also, try to be entertaining – don't drone through the procedure in a monotonous voice. It has to have some cadence to it; it has to be fun.
- Most importantly, remember to enjoy yourself. Live surgery is not an easy task, but it is fun, and a great and enriching learning experience.

Confession

Sometimes surgical terms don't hold the same meaning in other languages. In the US, I use 'topical' anesthesia for my cataract cases, which means I use anesthetic drops as well as patient sedation. At my first Italian live surgery event, when I requested topical anesthesia for my patient – a sweet little grandmother – they presented me with a bottle of tetracaine and said, "Go ahead!" When I queried if they were going to administer sedation they replied, "No! You said topical!"

"Oh my god. How am I going to do this?" I thought. Asking someone to help me translate, I told the patient she looked exactly like my grandmother and I was going to perform the same beautiful surgery that I did for her. That was like her sedation – it calmed her right down! I also learned one important phrase that helped hugely with the procedure: "Signorina, per favore guarda la luce." And I don't speak Italian!

KEEP CALM AND CARRY ON PERFORMING

Live surgery is great, but sometimes it's complicated… I share my top tips

By I. Paul Singh

Most know me as an ophthalmic surgeon. But outside the clinic I play keyboard in a band, and the experience has really influenced my surgical skills. Not only has it helped me strengthen the ability of my non-dominant hand, it has helped me when it comes to performing live surgeries.

Pretty much every surgeon, whether doing live events or presenting on the podium, gets a little nervous. Me too – I'm not immune to a bit of stage fright! Performing live on stage with my band and talking to the audience has definitely helped me learn that your approach is what matters.

Leading up to the event is the most nerve-wracking part. It will likely be on your mind the night before and in the morning when you wake up. Then you get to the operating room to find all the cameras and the production team; it can feel a little overwhelming. But if you're feeling stressed, you just need to revert back to basics. You're talking to your colleagues, and they are learning from you. Some of your surroundings might be unfamiliar – the microphone on your scrub and the camera in your face – but once you sit at the microscope or laser and get started, it isn't any different to the thousands of cases you've performed before in your own office. It is just you and the patient, and you automatically revert back to your muscle memory. I find it is helpful to make your surroundings as familiar as you can, whether it is how you sit or the chair you use.

EXPECT THE UNEXPECTED

You may have a version in your head of how you expected the surgery to go. But if it doesn't go that way, don't panic. If a complication does occur, just take a pause to re-evaluate. Those 10 seconds might feel like an hour in your mind, but they can help you stay calm and go back to the 'basics' of the procedure that you are trying to teach the audience. This brings to me a key piece of advice – be prepared to expect the unexpected. Surgery is surgery. No matter how much you plan, unexpected things can happen (See 'A series of unexpected events'). If things don't go the way you planned, turn it into a teaching tool – tell the audience: "This is part of real surgery." It's important because the learning process for everybody is not just a perfect case! And that's actually the beauty of live surgery – it's unedited. A bit of a challenge is good because every surgeon encounters challenges – and it makes it more real for the audience. Just keep talking through what you are doing to overcome the challenge and it all adds to the learning experience for the audience. It also helps to remember that much of the time you're teaching colleagues who haven't had as much experience with the topic as you. So even if something doesn't go the way you hoped, they're not necessarily going to know the

A series of unexpected events

- One time, I was moderating a live femtosecond laser-assisted cataract surgery case – and the suction clip fell off. The surgeon and I looked at each other. There was nothing to do but start stalling. "Let's talk about some of the different nuances of the laser," I told the surgeon. And it turned out well because while he was re-docking the suction clip, we got to talk about the features of the laser. It wasn't a big deal!
- You just have to take these things in your stride. Also, it shows how important it is for the moderator to think fast on their feet to minimize any impact to the event.
- On two separate occasions, I've been in South America to provide some teaching on laser floater removal. But arriving at the venue, I discovered my host had arranged live surgeries for me to perform as well. One included a patient who had a history of vitreous trauma – not the easiest case – and the host's son who had a floater! Honestly, I was extremely nervous being confronted with these surprise live surgeries. But I just went with the flow and took my mind to being back in my own office. As soon as I sat down at the laser, muscle memory kicked in. The case where the patient had prior vitreous hemorrhage was tough but it went well; afterwards, the case host revealed he'd set that one up to test how good I really was…

difference! I've made many mistakes when on stage with my band and thought "Oh no – I suck!" But the audience don't really know what the song was supposed to be, or were focusing on the next part of the song. How you approach the performance – musical or surgical – is the important part. Keep smiling and keep going!

A SOCIAL COMMENTARY

Live surgeries are a key learning element for surgeons at all levels of experience. The more surgical interaction we can have, the more we can learn from each other. I've found the news that some companies are considering slowing or shutting down live surgery events disappointing. I do hope that they will continue to support them in the future because it is so important to have the ability to share ideas and experiences in this way.

With this in mind, I am hoping smaller events will incorporate live surgery as part of their program. A group of glaucoma surgeons have helped to create a meeting called, "The Glaucoma Forum." As part of this, we are hoping to host an interactive live surgery event on the decisions and different factors influencing the choice of MIGS procedures in patients. We're excited about the idea – and it will likely serve as a great teaching tool. Watch this space!

I. Paul Singh is President of The Eye Centers of Racine & Kenosha, Wisconsin, USA.
Singh reports that he is a consultant for Ellex.

"TEACH A MAN TO FISH…"

International ophthalmology is about so much more than just performing live surgeries

By Steve Charles

I don't like the term "medical mission." I actually recoil when people use it. Over the past 42 years, I have performed live vitreoretinal surgeries in 25 different countries in a variety of venues, but I'm not a missionary – I'm just sharing my surgical experience with my colleagues across the world.

International ophthalmology is never just about doing volume surgery. True international ophthalmology is about a multiplier effect – think of the old adage "teach a man to fish." If you just perform a load of surgeries, you're not really helping to improve the status quo, because you're not leaving much behind. But if you truly partner with your ophthalmology colleagues abroad, you can have a sustainable impact; you can ensure that they can deliver volume care based on your teaching – as well as passing that teaching on to others.

REAL SUSTAINABILITY

Promoting surgical efficiency is a key early teaching. On my first trip to Beijing, I found they were performing two or three cases a day and had 20 or 30 employees in the operating room. In my operating room in Tennessee, I do 12 cases a day and have two employees! They had a two-year waiting list and people were going blind; teaching them how to be fast and how best to use their equipment and human resources was vital.

Building relationships and maintaining contact is key – as is sharing resources. If you have any books or papers that you can take over and give them, please do; it will support what you have demonstrated in the operating room. Furthermore, if you can share the resources on screen to describe what you are doing beyond the operating room, it has a huge multiplier effect. Even in 1987, when I was operating on the Orbis DC-8 Flying Eye hospital in Moscow, a black and white TV in the cabin screened what was happening in the operating room. When in Beijing on the Orbis DC-10 in 1994, there were way more doctors than could fit into the aircraft, so a large screen was installed in the hangar to allow more people to watch the surgery. And because the doctors were 'on site', they could alternate physically coming on board the plane and asking questions – a much higher level of engagement than just live-streaming the surgery on the web.

Sustainability isn't just about partnership and education, it's also about ensuring feasibility; there is no point using fancy equipment in a live surgery, if that particular location will not have access to it when you are gone. You also need to make sure they have sufficient finances to source the consumables needed for the surgeries. 'Vetting' hospitals to assess infrastructure, as well as the best and most ethical people to teach and pass on knowledge, means that your efforts are likely to be more sustainable. Collaborating with the right people is also important. When attending international meetings, it is always worth seeing who shows up and gives the most insightful and interesting talks; these are typically the leaders in the field back in their country, and are often the best people to collaborate with to ensure sustainability.

The do's and don'ts of international ophthalmology

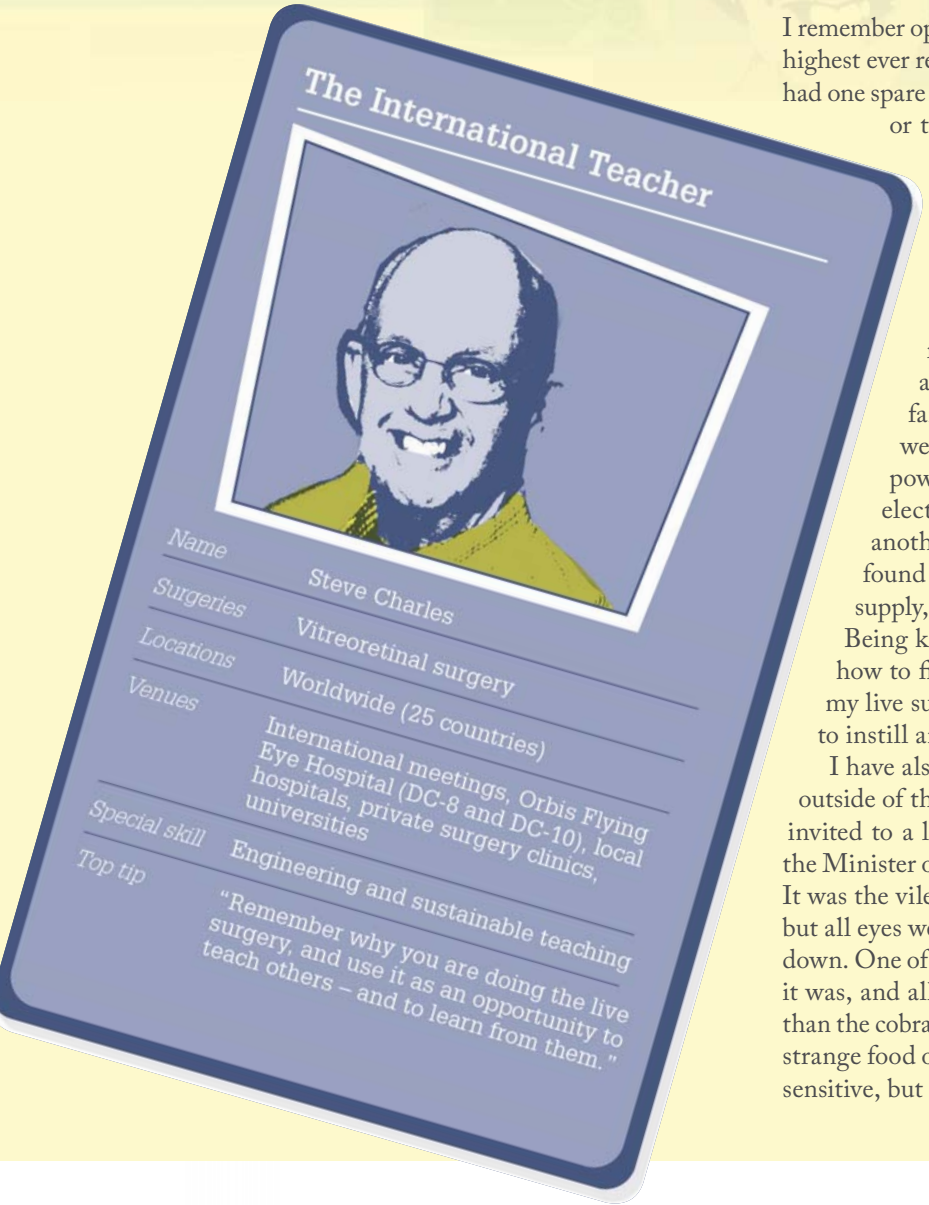
DO

- Take a sustainable approach – train the trainers and teach the teachers. Partner with your new colleagues and share skills. Build relationships and maintain email contact. Even facilitate visits to your operating room. All this ensures an ongoing sustainable approach beyond performing surgeries.
- Be culturally sensitive.
- Make sure you are delivering the highest care possible.
- Use their team and their equipment. If you bring technology that they cannot afford, it isn't sustainable.
- Emphasize medical ethics and post-operative care. Also teach when to operate and when not to operate.
- Teach and instill the importance of efficiency – 70 percent of surgery costs are labor.
- Watch your ego! International ophthalmology is not a 'photo-op' for practice building at home.

DON'T

- Show off. There is no need to show an extreme triple procedure. Perform and show a mainstream procedure; something that will be encountered frequently, but can be a little bit difficult. There is no point demonstrating a really uncommon case that might never be encountered again.
- Use the term 'third-world country'. If you really must assign a title use the term 'developing country.'
- Drink too much or party too hard…
- Forget why you are there!

Confession



I remember operating in Beijing, when the temperature hit the highest ever recorded. Unfortunately, the operating room only had one spare electric outlet, so either the air conditioning unit or the laser we needed for the procedure could be plugged in. They cut the back out of my scrubs; and when I wasn't using the laser they blew cold air onto my bare back so the sweat wouldn't drip off my head and onto the patient!

I have a lot of experiences where my engineering background came in handy. I remember operating in Havana with Orbis, and the power generator and the air conditioning failed. Because the engineers had left the plane, I went and checked what was wrong with auxiliary power unit. I fixed it and got it re-started, restored electrical power and finished the case. Similarly, another time in Singapore, the microscope failed. I found some tools and a ladder, took apart the power supply, and fixed it so that the case could be finished. Being knowledgeable about how equipment works and how to fix it on the fly has definitely been important to my live surgery experiences. Wherever I go, I always try to instill an understanding of how the equipment works.

I have also had some interesting live surgery experiences outside of the operating room. Once again in Beijing, I was invited to a large reception where I was seated across from the Minister of Health. He handed me the aperitif: cobra bile. It was the vilest smelling substance I had ever encountered – but all eyes were on me. So I knocked it back and slammed it down. One of the Englishmen at the same table asked me how it was, and all I could say was that it was much finer quality than the cobra bile we drink back home! So every now and then strange food objects might appear. It does pay to be culturally sensitive, but I do have rules...

INTERNATIONAL GUIDELINES

In my opinion, there are too many surgeons who can't wait to travel to a country with eyecare challenges, perform a handful of cases, spend four weeks climbing a mountain or sightseeing, before returning back home and declaring that they are a philanthropist. I think it is simply wrong to go to another country and spend one day pretending to help people so you can put it on your Facebook page or declare a victory in your local church. When I am performing international surgeries, I try to send the right messages (see 'The do's and don'ts of international ophthalmology'). I don't need to go on a VIP trip to the Taj Mahal or the pyramids; I don't want a fancy private dinner with the chairman of the department or the President; I don't want to be given an award or have my picture taken for the wall. I am just a regular surgeon, and I want to spend time with all the doctors that I am there to work with. I'm not saying that all sightseeing is bad – if your international colleagues are proud of their culture and initiate the process it is a wonderful way to build collaborative relationships! I just think that spending the majority of your time vacationing and resting can send the wrong message. I also discourage gifts – I would much rather see money being put into equipment and education.

International ophthalmology is about so much more than going and performing live surgeries, it's really about delivering sustainability. And it is not about you. Train the trainer and leave behind a legacy of better care.

Steve Charles is a vitreoretinal surgeon and founder and owner of Charles Retina Institute, Memphis, Tennessee, USA.

STREAMING REALITY

Live streaming is an exciting extension to the clinical practice of ophthalmology

By James Lewis

As a cataract and refractive specialist, a typical week involves seeing patients and performing surgeries, just like many other ophthalmologists. What isn't so typical is that every week I live stream approximately 50 of my cases via YouTube and my website, LASIKTV.com.

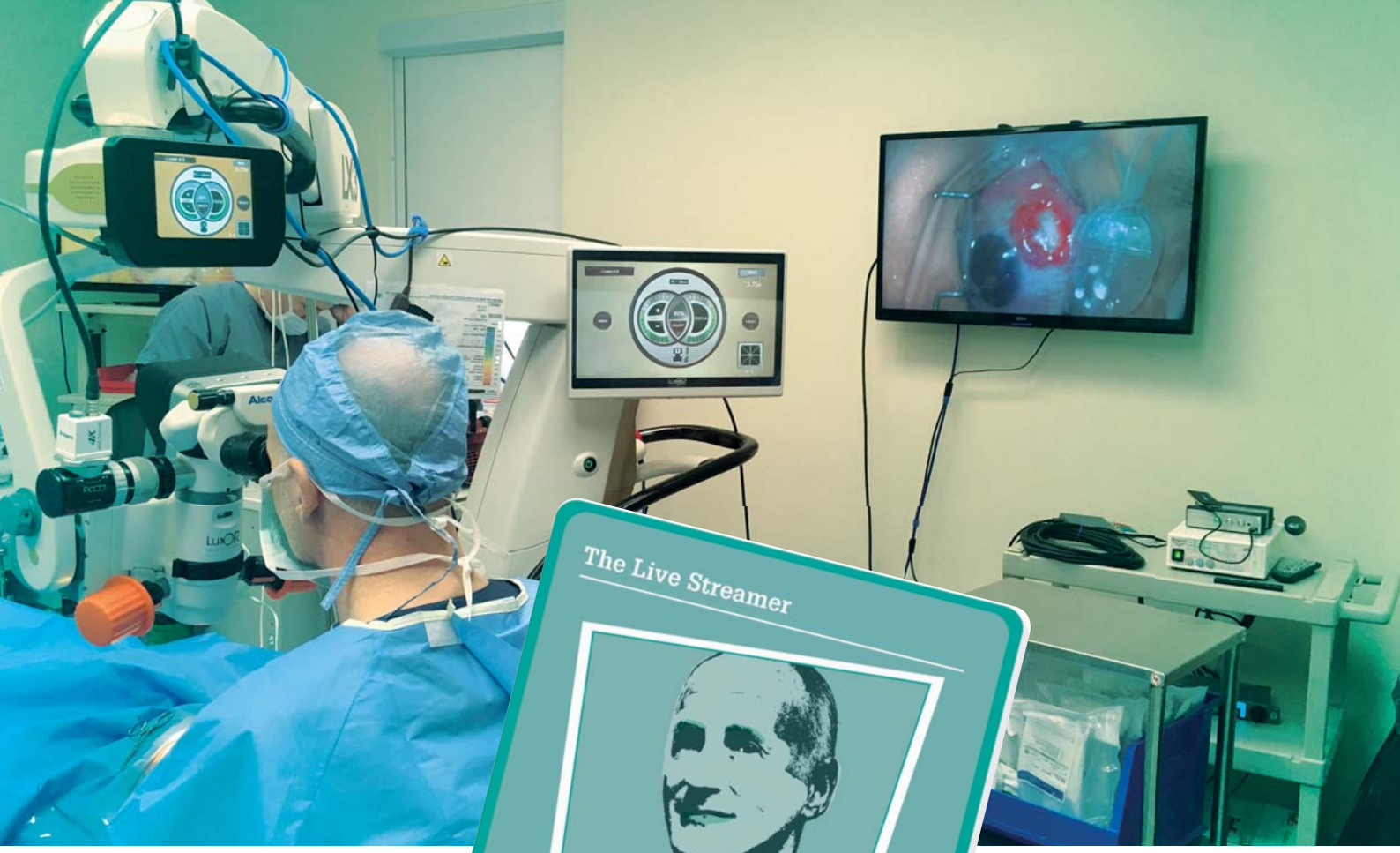
What inspired me to do this? Live streaming my surgeries demystifies ophthalmic surgery for the public, as well as demonstrating LASIK and anterior segment surgery for prospective patients. The live surgery also enhances communication with fellow surgeons, provides students and clinicians with an appreciation of techniques painfully absent in highly edited videos, and allows me to compare my techniques with other practitioners.

GOING LIVE

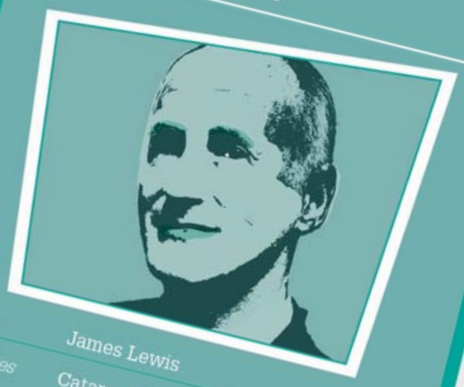
I first began recording my cases in the 1990's and handed VHS tapes to my patients. I then migrated to DVDs and finally to YouTube streams. I actually found the first cases psychologically atraumatic because I was accustomed to being observed by residents, fellows, referral sources – and the occasional insistent family member. It is actually reassuring to know that your best efforts are memorialized and the management of difficult clinical scenarios is well documented. I also retain 4K copies of interesting cases for lectures or other presentations.

Incorporating streaming into surgery has been incredibly useful. At the end of the case, I can collect the YouTube URL and paste it into the patient's chart as well as forward it to their email address. The live surgeries also enhance the patient-physician relationship through generating a level of understanding and appreciation – questions are answered and patients are often reassured that I am willing to provide unrestricted access to my surgery. Some are interested in the mechanics and find viewing the procedures calming; some appreciate the realism. Referral sources also enjoy watching select cases, which helps with patients choosing my practice. Students have found that streaming extends their educational experiences, and I have used live streaming to teach hundreds of surgeons transzonular instillation of antibiotics/steroids.

I have also used my streaming to help device manufacturers assess new instruments, as they can gather vital information from live remote observation. Furthermore, while the pundits contemplate the merit-based incentive payment system (MIPS)



The Live Streamer



Name	James Lewis
Surgeries	Cataract, CAT/MIGS, Valves and Shunts, DSEK, Lens Exchange, Visian ICL, LASIK and PRK
Locations	USA
Venues	James Lewis MD, Pennsylvania; YouTube: LASIKTV.com
Special skill	Routine performer, enhancing physician-patient relationships
Top tip	"Live streaming can help demystify ophthalmic surgery, as well as enhance patient-physician relationships. It also helps me in my practice too!"

and other clinical assessment tools, I find that video preservation of clinical and surgical encounters to be far superior to all the arduous documentation. Furthermore, live streaming can convince a skeptical insurance company that a cataract surgery should be reimbursed as 'complex'.

Despite expanding hard drive capacities and improved compression techniques, nothing compares to the permanent, limitless, zero cost, secure storage provided by YouTube. Fellow ophthalmologists who are interested in live streaming should first optimize their microscope, their video adapters, cameras, recording systems and monitors. Next, they should explore software, webcams, and format converters/switchers so the production remains trivial yet polished. With the growing popularity of webcasting and streaming, the market is replete with highly professional and affordable devices.

A staff member, preferably someone motivated, should act as the Director. I defer all streaming decisions to the Director so that I can focus on entirely on the procedure. Before your first live streaming, master the camera software, resolve network considerations, finalize camera positions and establish a protocol for the video sequence. Sound, color, brightness, contrast, centration, patient privacy – and staff demeanor – must be established before you go live. Also remember that the quality and content of the live stream is of course secondary to the well-being of your patient; you should 'de-stream' if the clinical situation warrants or convert the stream to private.

My next endeavor is to video-document my clinic securely online. For now, catch me every Friday and every other Monday on my YouTube channel, and every Wednesday on my LASIK channel!

James Lewis is a cataract and refractive specialist in Elkins Park, Pennsylvania, USA.

Lewis' live streamed surgery can be watched on YouTube via the following link: www.youtube.com/user/jslewisMDPC. Live LASIK surgeries can be viewed through: lasiktv.com

Technology to Empower: Cataract

Cataract surgery is one of the most ubiquitous procedures in ophthalmology – in fact, it's the most commonly performed elective surgical procedure in the world today. With a strong history of innovation and development, today's cataract surgery offers better outcomes than ever – and this trend is set only to continue. Here, leading ophthalmic companies showcase their latest cataract surgery technology, and explain what these advances mean for you and your patients.

THREE WORDS: SIMPLICITY, QUALITY, PERFORMANCE

SAV-IOL's Lucidis IOL combines the fantastic far vision and few photopic phenomena of a monofocal lens, with the added bonus of a high-quality extended depth-of-focus.

In some respects, monofocal IOLs are hard to beat. Other than the obvious – a single focal plane – the drawbacks are few, and compared with the current crop of diffractive multifocal IOLs, they provide unparalleled distance vision with a very low rate of visual disturbances. Neuroadaptation is rapid, and patients are almost immediately comfortable with their postoperative vision.

The Swiss IOL company, SAV-IOL, set out to make a lens with all of the advantages of a monofocal IOL, but with the benefit of continuous vision. To that end, they adapted their "Instant Focus" extended depth-of-focus (EDOF) technology to a classic monofocal design to make Lucidis – a hydrophilic single-piece foldable IOL. The optic comprises a 6 mm-diameter refractive part providing distance and a 1 mm-diameter aspheric element in the center of the optic to extend the depth of focus from near towards distant vision (Figure 1a,b). The aspheric element uses a pseudo non-diffracting beam (PNDB); the benefit of this approach being the maintenance of a constant resolution and light intensity on the retina (Figure 1c).

Since its launch at the ESCRS in October 2017 in Lisbon, Lucidis is gaining worldwide interest among the ophthalmic surgeons' community.

Here's what the surgeons who use it think:

Dr Johan Blanckaert, Belgium

"We can see that a growing number of patients are willing to have multifocal IOLs – but many are reluctant to choose this type of lens because of the optical side effects (halos and glares) that traditional diffractive multifocal lenses are known for. These patients need an IOL that's capable of multifocality, with the least possible visual disturbances. Lucidis with its 'Instant Focus' EDOF technology perfectly fills this gap."

"I was expecting a moderate reading capability and I warned my patients that they might need a low diopter reading glass for small print. However, to our surprise, the reading capability was very good, even for small print."

Dr Marco Alberti, Italy

"Compared to monofocal lenses, premium IOLs come with an added cost. For patients, the cost is financial, for surgeons, the cost is added time. Lucidis can be an appropriate solution for surgeons put off by the extra time needed to explain those technologies. You can present the Lucidis lens as a standard monofocal IOL with the possibility to have a better visual acuity for the near and intermediate vision."

"As squared shape platforms in a round bag are more prone to decentration in cases of anterior capsule retraction, I feel more confident with the strength of the platform of Lucidis, because of the profile of its closed-loop haptics."

"The Lucidis lens has a very stable design – its stability in the capsular bag is great, and I get perfect centration. I was skeptical in the beginning regarding the smaller 10.8 mm diameter model, but the haptic design is strong, and the 10.8 mm version is a very good compromise. Furthermore, the 12.4 mm version perfectly fills up the largest capsular bags!"

Dr Frédéric Sutto, Belgium

"Lucidis is positioned between monofocal and multifocal IOLs, and I think there's a growing population of patients requiring cataract surgery who will benefit from such a lens. To me, one of the main benefits of Lucidis is the regularity of results: typically 9/10, P2."

Prof Dr Hanefi Çakır, Turkey

"I realized that implantation and manipulation of Lucidis are extremely easy – right from the very first time I used it. When patients came for post-op examination, I always saw smiling faces, as they were able to see very well for both near and far, without any halo or glare."

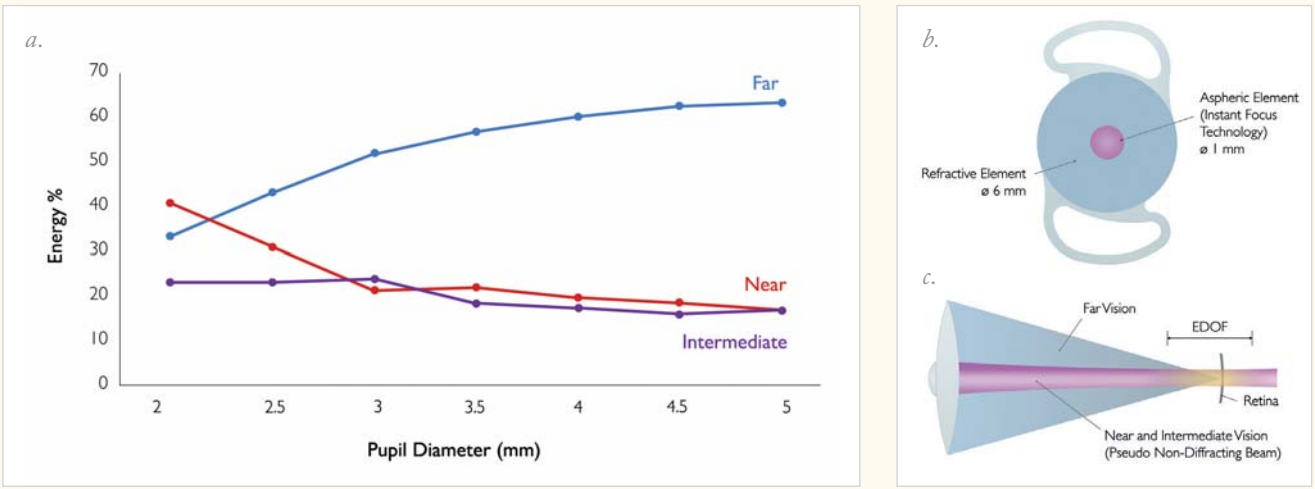


Figure 1. a. The Lucidis IOL – available in two sizes (10.8 mm and 12.4 mm) with a power range of +5.0 D to 30.0 D, in steps of 0.5 D; b. The refractive and aspheric optical elements with the innovative closed-loop haptic design to give an optimal centration; c. The pseudo non-diffracting beam approach providing a constant resolution and light intensity on the retina.

BETTER, BY DESIGN

Zepto™ is a novel automated capsulotomy system that has no direct competition.

What is Zepto Precision Pulse Capsulotomy? It's the combination of a power console, fluid isolator, a disposable handpiece with (the genius part): the Zepto tip, which creates circular capsulotomies that are, on average, 2–3 times stronger than those created by CCC or femtosecond lasers (1) – and, at the same time, allows surgeons to easily center the capsulotomy on the visual axis.

The Zepto tip (Figure 1) consists of a circular, collapsible micro-molded silicone suction cup that is 6.1 mm in diameter, 1.18 mm in height and contains a 4.4 mm nitinol ring that produces, on average, a 5.2 mm capsulotomy. The ring is inserted using the handpiece through a 2.2 mm or greater clear corneal incision. The Zepto push rod is retracted and the device unfolds back into a circular shape. The surgeon centers the clear suction cup tip over the visual axis, applies suction (gently, but securely locking the tip in place) before a 4 ms pulse of electrical energy is delivered to the nitinol ring. This triggers a rapid phase transition of the water molecules that are trapped between the device and the capsular membrane – instantaneously creating a cleavage plane in the capsular membrane, making a strong capsulotomy, yet remaining gentle on the eye.

My Journey to Zepto

My involvement with the Zepto capsulotomy procedure evolved out of learning the importance of centering cataract surgery on the visual axis. I used to center my manual capsulotomies on the pupil – but I was seeing a lot of patients where I did not get a 360° overlap of the optic; with capsule fibrosis and contraction, I had a higher incidence of lens tilt and decentration than I'd like.

When I started using femtosecond lasers, I could consistently achieve a round capsulotomy of the desired size, but I still had inconsistent anterior capsular overlap of the optic. I moved to an OCT-guided femtosecond laser, which helped guide the capsulotomy to the center of the lens. My anterior capsular overlap rate improved – but there was still a significant number of cases where I did not achieve overlap. Why? Patients cannot fixate with a femtosecond laser when it applies suction to the eye.

The landmark Chang-Waring paper (2) not only taught me why centering the capsulotomy on the pupil did not give me consistent overlap, but also the Purkinje method of centering on the visual axis, and the importance of patient fixation on the microscope light during the capsulotomy procedure.

I went back to manual capsulotomies, marking the cornea with an optical zone marker centered on the visual axis. My anterior capsular overlap rate improved, but I was back to less round and consistently sized capsulotomies. Nevertheless, it is a major challenge following a corneal mark and moving the eye along with the patient's intermittent fixation and eye movement. I knew that if I could consistently center this important part of cataract surgery on the visual axis, I could further improve my rate of capsular overlap.

I then had to opportunity to be a Zepto investigator in their FDA-monitored trial and have adopted this technology into my practice. What has amazed me about the Zepto technology is that I now have a guidance system of a perfectly round device of the proper size that, with the patient fixating on my microscope light, I can center in one motion to guide and create my consistently centered capsulotomy.

My rate of anterior capsular overlap of the optic went up tremendously (Figure 2), and Zepto is now a mainstay in my practice. When the capsule contracts over time, tilting or decentration of the optic are minimized because of this consistent overlap – which in turn lessens the chance of the induction of dysphotopsias associated with these processes. I am very happy with Zepto.

Vance Thompson, MD

Reference

1. *VM Thompson et al., "Comparison of manual, femtosecond laser and precision pulse capsulotomy edge tear strength in paired human cadaver eyes", Ophthalmology, 123, 265–274 (2-16). PMID: 26707416.*
2. *DH Chang, GO Waring, "The subject-fixated coaxially sighted corneal light reflex: a clinical marker for centration of refractive treatments and devices", Am J Ophthalmol, 158, 863–874 (2014). PMID: 25127696.*

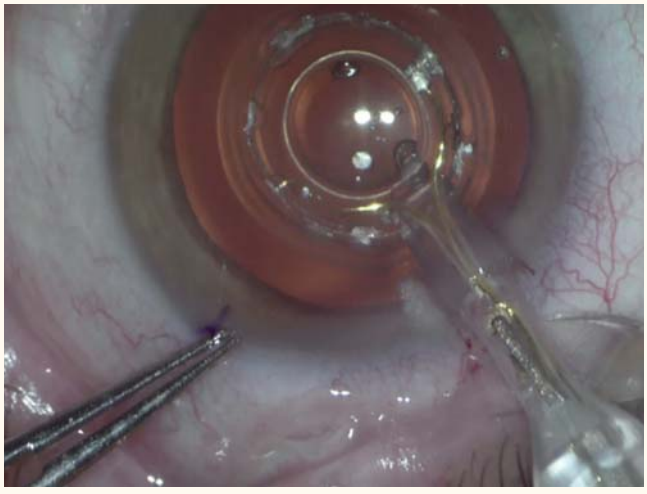


Figure 1. The Zepto tip being aligned over the visual axis.

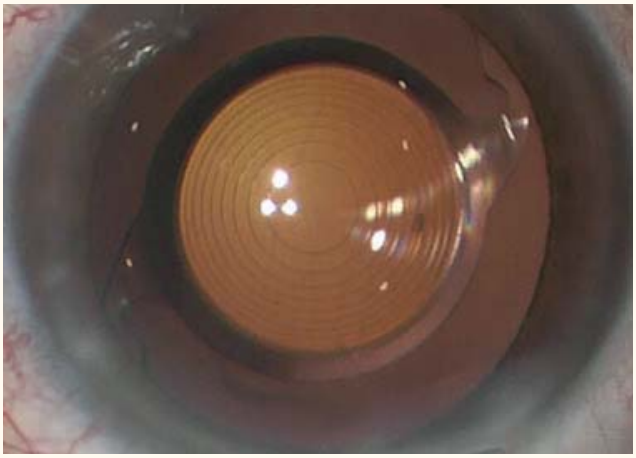


Figure 2. The rate of anterior capsule overlap of the optic for 360° with Zepto helps to minimize lens tilt or decentration with capsule fibrosis and contraction.

TWO IN ONE

Anterior segment tomography and IOL calculation all-in-one device: the OCULUS Pentacam® AXL

All surgeons want the best for their patients, and when it comes to refractive outcomes, anterior segment analysis plays a key role. The Pentacam® and Pentacam® HR provide a gold-standard in anterior segment tomography. Now meet the newest member of the family – the Pentacam® AXL.

Based on the trusted Pentacam® HR system, which offers high-resolution Scheimpflug imaging, the Pentacam® AXL offers the additional feature of axial length measurement – a crucial part of accurate IOL calculation and customized IOL selection. Through partial coherence interferometry biometry, the Pentacam® AXL collects several successive axial length measurements; patient eye movement is detected by the pupil camera and corrected for, and a 3D model of the anterior segment based on ray tracing allows for the correction of individual optical distortions. Using fourth generation IOL formulas, the system can automatically calculate IOL power. Because the total corneal refractive power (TCRP) map shows the influence of the posterior corneal surface with regard to total corneal astigmatism axis, magnitude and regularity, the IOL calculation software can account for posterior corneal astigmatism. The software also accounts for prior refractive surgery and pre-existing conditions, ensuring a reliable IOL power calculation for any IOL type in both virgin and post-refractive eyes.

The upshot? The Pentacam® AXL enables full screening before corneal refractive and cataract procedures. Laser vision correction procedures can be planned effectively; patients can be screened for existing diseases such as Fuchs endothelial dystrophy or angle-closure glaucoma; prior refractive surgeries can be detected; and crystal lens densitometry can be used to plan femtosecond laser-assisted cataract surgery (FLACS). Now, accurate IOL calculation can also be achieved – as well as customized IOL selection regarding multifocal, toric and aspheric IOLs, all from one device.

OCULUS®

Pentacam® AXL in Action

A case study by Ina Conrad-Hengerer, MD, University of Heidelberg, Germany.

A 63-year-old woman presented with subjective loss of visual acuity and increased glare. Corrected distance visual acuity (CDVA) was reduced in both eyes; 20/63 (-0.5 D -1.0 D × 98°) in the right eye and 20/40 (-1.0 D -0.75 D × 75°) in the left eye. Examination of the anterior segments revealed senile cataract without corneal pathology. Before medical mydriasis or further examinations, Scheimpflug imaging and anterior segment analysis by Pentacam® AXL was performed. The postoperative target refraction was emmetropia for distance, and fundoscopy showed no macular changes.

The TCRP map showed increased corneal astigmatism of the axial topography from 0.9–1.6 D (right eye) and from 1.4–1.8 D for the left eye, respectively (Figures 1 and 2). Usually, toric IOL implantations are considered based on spectacle correction and anterior corneal keratometry values – but that approach would not have identified this result. Total spherical corneal aberrations (6 mm zone) were 0.353 µm (right eye) and 0.305 µm (left eye), revealing that an asphericity-correcting IOL could be a good option. Total corneal irregular astigmatism (4 mm zone) was 0.154 µm (right eye) and 0.145 µm (left eye); as 0.3 µm is the recommended limit to avoid photic phenomena, multifocal IOLs could be offered to this patient.

The IOL calculations are presented in Figure 3. Femtosecond laser-assisted cataract surgery followed by implantation of monofocal aspheric toric IOLs was performed (right eye, +18.0 D 1.5 D/6°; left eye, +18.0 D 2.25 D/6°). One day after surgery, UDVA was 20/20 in both eyes, increasing to a UCVA of 20/16 one month after surgery. Objective refraction measured by Nidek AR310A was +0.25 D 0.25 D/110° (right eye) and plano -0.25/60° (left eye).

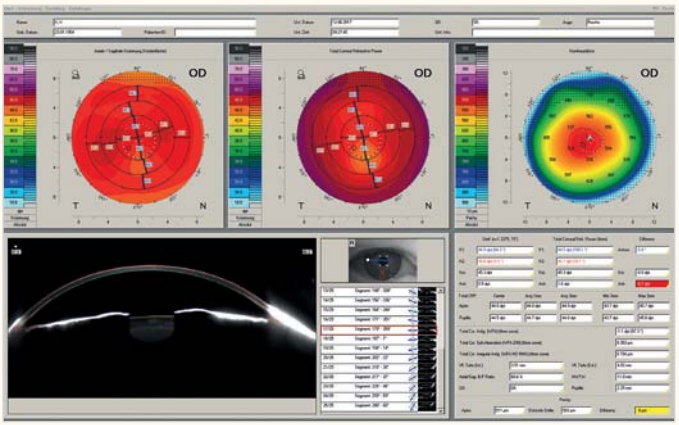


Figure 1. TCRP map for the right eye.

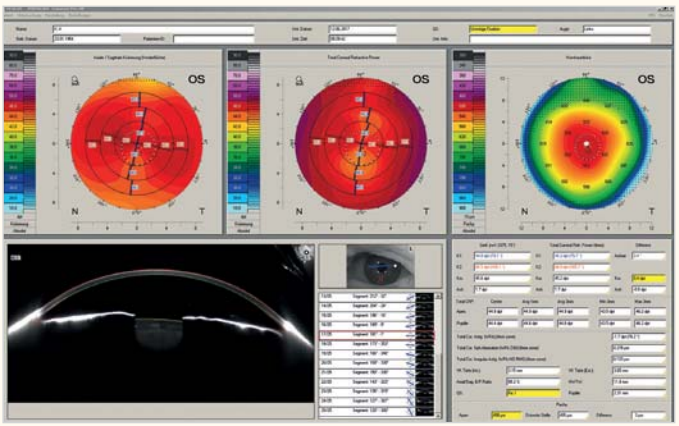


Figure 2. TCRP map for the left eye.

Figure 3. IOL calculations.

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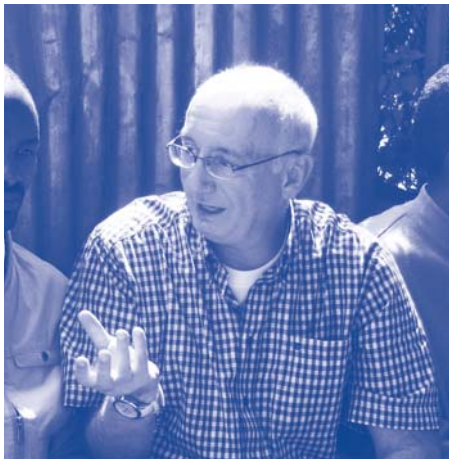

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Richard Jähnke, Global Pharma Health Fund (GPHF), developed and continuously improved GPHF Minilab – a "lab in a suitcase," enabling resource poor countries to rapidly identify substandard and falsified medicines.

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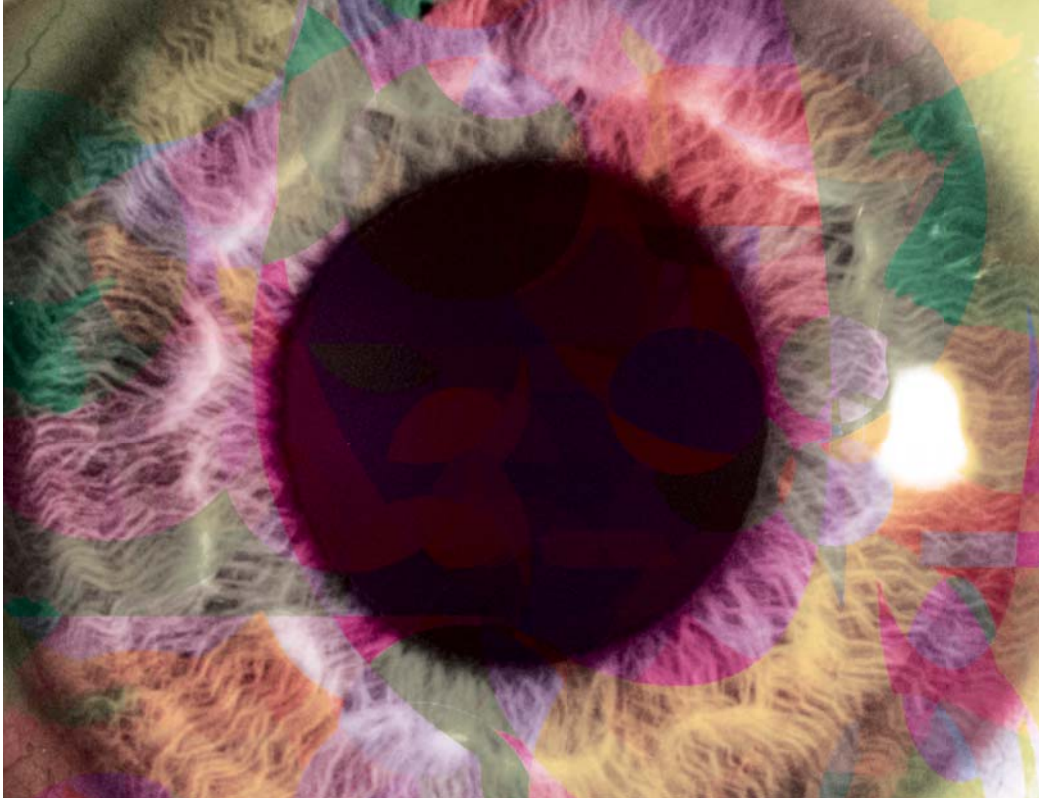

Minimally Invasive Corneal Neurotization

A new paradigm in managing neurotrophic keratopathy

By Ilya Leyngold

Neurotrophic keratopathy can be a devastating disease (See Box 1. Neurotrophic keratopathy pathology). Lost corneal sensation may lead to corneal scarring, ulceration and thinning, which can lead to corneal perforation and vision loss. It's a debilitating condition for patients, and doctors have limited treatment options. Multiple 'temporizing' treatments try to decrease the chance of infection, ulceration and scarring, such as ocular lubricants, topical antibiotics, autologous serum drops, contact lenses, amniotic membrane grafts, and tarsorrhaphy. But none restore corneal sensation or the ability of the eye to respond appropriately to stimuli and maintain a healthy ocular surface. Furthermore, patients with neurotrophic keratopathy do poorly with corneal transplantation to replace the damaged tissue, because the same condition will recur in the corneal graft resulting in failure.

The traditional standard of care for severe cases is to suture the eyelids together to protect the surface of the eye – a disfiguring procedure, which at best limits the patient's field of vision and may lead to functional blindness if the entire palpebral aperture is closed. Some patients end up with permanently closed eyelids because corneal decompensation recurs upon re-opening. A novel surgical treatment has been described – corneal neurotization (1) – but the original techniques involve a significant undertaking. They involve either a coronal (ear-to-ear) incision with peeling the scalp and forehead tissues down to the level of the eye socket, or use of a nerve autograft harvested from a patient's leg. Why? To route supraorbital and supratrochlear nerves from the contralateral side, tunnel them across the bridge of the nose, and to the corneoscleral limbus of the affected 'anesthetic' eye (1). These techniques for corneal neurotization have demonstrated successful outcomes – patients developed improved corneal sensibility, corneal health, and vision in some cases. But the means of getting there involve quite an invasive surgery with potential for significant donor site morbidity.

The sentinel patient with neurotrophic keratopathy who sparked my interest in this procedure presented to my clinic with severe corneal decompensation. In the four months following a retinal detachment repair surgery, she developed a non-healing corneal epithelial defect, thinning, and progressive loss of vision in her left eye despite maximal medical therapy. With hand motion vision, she was miserable and desperate. I wasn't satisfied that there was nothing we could do besides suturing her eyelids together, and after extensive research to see if any other options were in existence, I stumbled across the paper by Terzis et al (1), which described the original corneal neurotization technique – four years after it was published.

My cornea colleague and I decided to perform the procedure using a slightly modified technique – see Figure 1. The surgery took five hours and involved a large incision and extensive surgical manipulations. Fortunately, the patient ended up doing very well; her corneal sensation was restored with complete healing of her epithelial defect and

At a Glance

- *Neurotrophic keratopathy – the loss of corneal sensation – has a poor prognosis with limited available treatment options*
- *Current techniques for corneal neurotization can restore corneal sensation, but may be associated with significant morbidity*
- *I describe two minimally invasive techniques for corneal neurotization: using a cadaveric nerve graft and an endoscopic approach*
- *More ophthalmologists learning – and performing – these minimally invasive procedures may help more patients before devastating and irreversible damage occurs.*

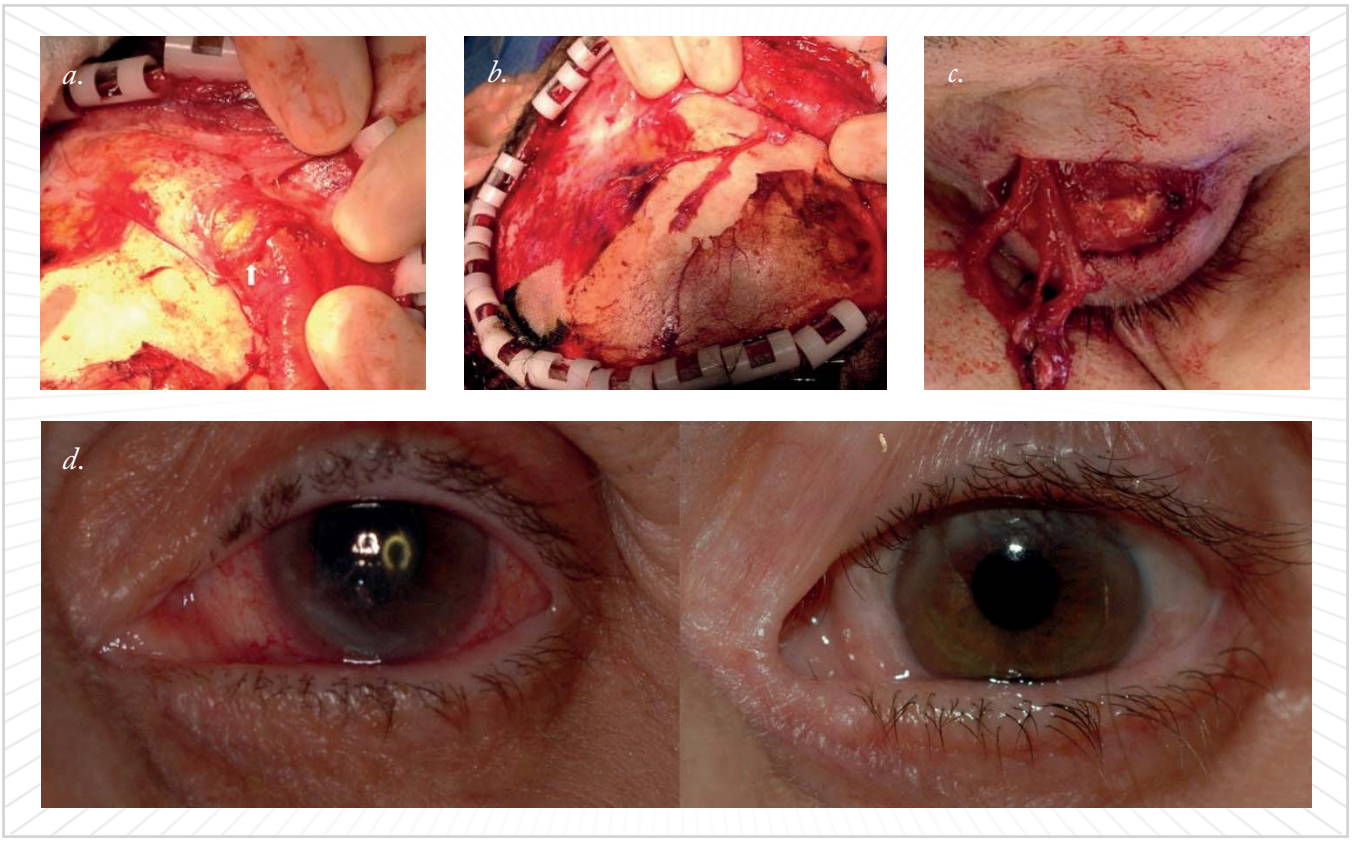

Figure 1. Direct corneal neurotization procedure in a 61-year old female with neurotrophic keratopathy. An ipsilateral hemi-coronal incision was performed and the supraorbital nerve was dissected (a, white arrow). The entire dissected nerve can be seen in (b). The supraorbital nerve branches were tunneled through an upper eyelid crease incision (c). Before and after (two years) pictures can be seen in (d).

improved visual acuity from hand motions to 20/30. I was able to open her eyelids, which were initially sutured together to protect her cornea (2). We were only the second center in the US to perform corneal neurotization; more groups have now reported performing similar procedures (3–5).

It was a revolutionary concept for me because it worked so well, but I thought there had to be a better – and less-invasive – way. One group reported using a sural nerve autograft to restore corneal sensation through coaptation with the supraorbital or supratrochlear nerves (4, 5). Although less invasive than the procedure we and Terzis et al had performed, I still wanted to find an option that would avoid another donor site morbidity. My goal became creating a less invasive procedure that would still provide good results.

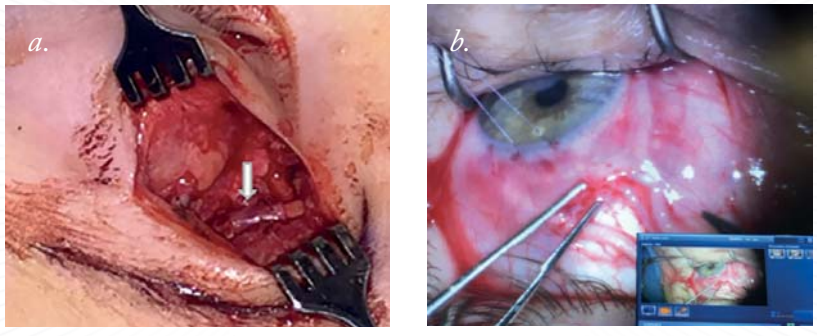

Figure 2. Use of cadaveric nerve graft for corneal neurotization. (a) Anastomosis (arrow) between the supraorbital nerve (left) and cadaveric nerve graft (right) through a an upper eyelid crease incision. (b) Nerve graft tunneled into the subconjunctival space and inset around the corneoscleral limbus.

Tackling invasiveness

Surgeons use cadaveric nerve grafts to repair nerve injuries in other areas of the body, so I thought why not use them to restore corneal sensation? It would circumvent the need for more invasive surgery to harvest grafts from the patient. Using de-cellularized and processed cadaver nerves (AxoGen, Alachua, Florida), I've performed the corneal neurotization procedure in five patients (Figure 2). Within three months of surgery,

Box 1. Neurotrophic keratopathy pathology

- Neurotrophic keratopathy is a degenerative corneal disease characterized by decreased corneal sensibility and corneal healing.
- It has a prevalence of 1/2,000 – but it is likely under-diagnosed.
- It is a potentially blinding disease that can involve persistent epithelial defects, corneal scarring, neovascularization, corneal ulceration, perforation, or even loss of an eye.
- Clinical findings of neurotrophic keratopathy result from multiple mechanisms, including decreased sensory neuromediators, limbal stem cell compromise, epithelial compromise, decreased blink reflex and decreased reflex tearing.
- Etiologies of the disease include: infection (HSV, and so on), neoplastic and neurosurgical procedures, trauma (such as skull base fracture), ocular surgery, systemic disease (such as diabetes mellitus or multiple sclerosis), topical medication, chemical burns, congenital conditions, and advanced age.
- The most common cause is herpetic corneal infections; the second most common is intracranial pathology.

Box 2. An endoscopic approach (7)

- Following induction of general anesthesia and injection of local tumescent anesthesia, make an upper eyelid crease incision in the donor upper eyelid. Dissect around 1 cm of the supraorbital nerve segment cephalad from the supraorbital foramen (or notch).
- Make two 1 cm vertical incisions just behind the hairline (5 mm posterior to the trichion). One incision should be placed in the midline and the other at a tangent to the contralateral medial limbus.
- Using a blunt endoscopic elevator, develop a subgaleal plane, stopping just cephalad to the previously isolated segment of supraorbital nerve.
- Using endoscopic guidance, dissect the rest of the supraorbital nerve cephalad through the scalp incisions, isolating terminal branches of the nerve.
- Tunnel the nerve branches through the upper eyelid incision.
- Make an upper lid crease incision on the side of the affected eye.
- Tunnel a curved hemostat from the eyelid incision on the affected side, in subgaleal plane, under the nasal bridge, and to the contralateral eyelid incision.
- Transfer the nerve branches from there to the upper eyelid crease incision on the affected side. After making a blepharotomy incision in the superior medial conjunctival fornix tunnel the nerve branches into the fornix of the affected eye.
- Place the nerve branches in the sub-conjunctival space through a conjunctival incision 8 mm above the 12 o'clock position, and secure the epineurium of the nerve to the sclera followed by conjunctival closure.

most patients demonstrated restoration of corneal sensation and improved corneal healing. Some of the patients actually noted that they could feel eye drops in the operative eye for the first time since developing neurotrophic keratopathy. Using a Cochet-Bonnet esthesiometer we were able to track their progress objectively, and we're thrilled with the outcomes – our results have been submitted for publication. We're also starting a prospective study to examine and further understand the outcomes following procedure.

We've also developed a second minimally-invasive technique – harvesting nerves using an endoscopic approach. This procedure involves making two small incisions behind the hairline – rather than a coronal incision – as well as a small eyelid crease incision (See Box 2. An endoscopic approach). First, we demonstrated the feasibility of using an endoscope for supraorbital nerve transfer to the corneoscleral limbus in two cadaver heads (6). We've also performed our endoscopic procedure in an 83-year old female patient with neurotrophic keratopathy from herpetic disease (7) (Figure 3). The affected eye had a visual acuity of hand motion at one foot, and a persistent corneal epithelial defect with dense corneal stromal scarring. Five weeks after the surgery, her epithelial defect had healed completely; and within three months of surgery we were able to demonstrate improvement in corneal sensation.

The merits of minimally invasive surgery

Both of our minimally invasive approaches have multiple advantages over the originally described corneal neurotization techniques. They're less invasive – you're not 'scalping' the patient or performing additional surgery elsewhere on the body to harvest a segment of nerve.

Another benefit of a minimally invasive procedure is that it makes corneal neurotization more accessible to ophthalmic surgeons who may not be as comfortable with previously described

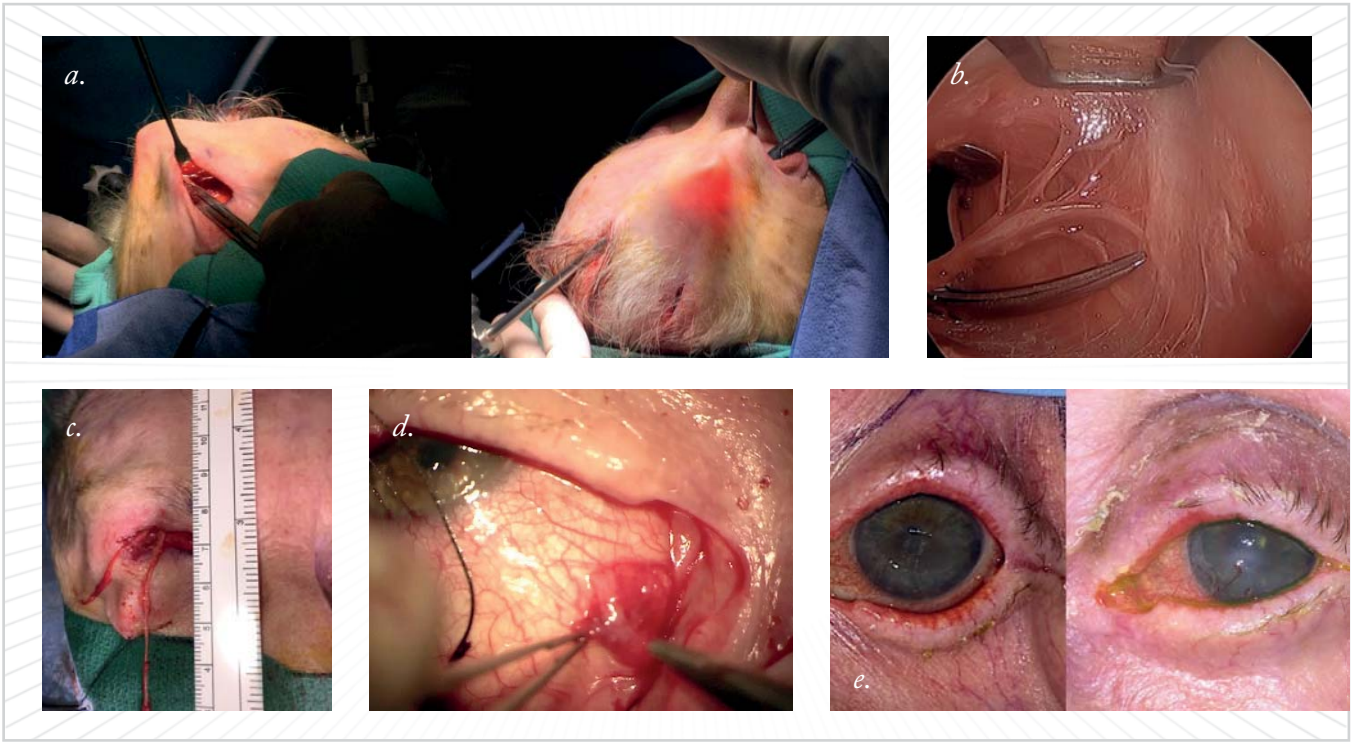

Figure 3. Endoscopic corneal neurotization. (a) Approach to the supraorbital nerve from a small scalp and eyelid crease incisions. (b) Dissection of the supraorbital nerve through an upper eyelid crease incision under direct endoscopic visualization. (c) Tunneled supraorbital nerve branches through an upper eyelid incision. (d) Inset of the supraorbital nerve into the subconjunctival space. (e) Resolution of persistent corneal epithelial defect five weeks after endoscopic neurotization procedure.

approaches. If there is a procedure that more ophthalmologists can perform, then more patients will be likely to receive treatment. We'll also be able to intervene earlier as patients will be more willing to undergo the procedure, rather than waiting until their disease becomes visually threatening. Currently, ophthalmologists who are aware of the procedure consider corneal neurotization a very morbid surgery. I am trying to change this perception – the minimally invasive procedures can be performed safely, with low complication rates, and are definitely within the scope of many ophthalmologists with proper training. The endoscopic approach is more technically challenging than grafting cadaveric nerves as it requires familiarity with using the endoscope, requires specialized equipment, and meticulous dissections in a small tunnel. Right now, corneal neurotization using cadaver nerve grafts is probably more reproducible, and I hope that in the future it might be picked up by more surgeons. I want to see corneal neurotization become a new paradigm in the management of neurotrophic keratopathy, and I want to see more patients cured from this disease.

Ilya Leyngold is Assistant Professor of Ophthalmology at Duke University School of Medicine, Durham, North Carolina, USA. He specializes in cosmetic and reconstructive surgery of the eyelids, orbit, lacrimal system, and face.

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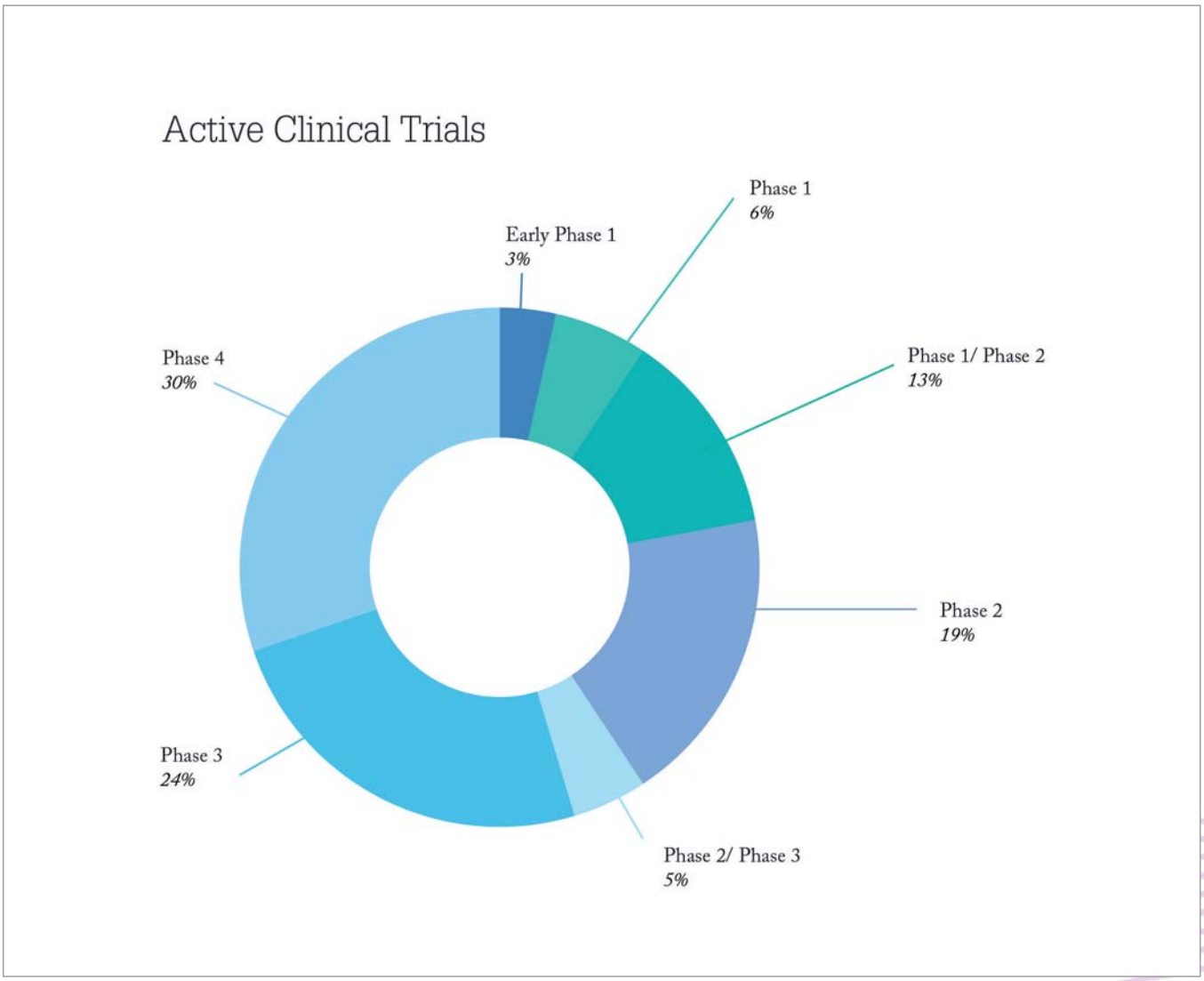
Benchmarking Cornea Clinical Trials

By Mark Hillen

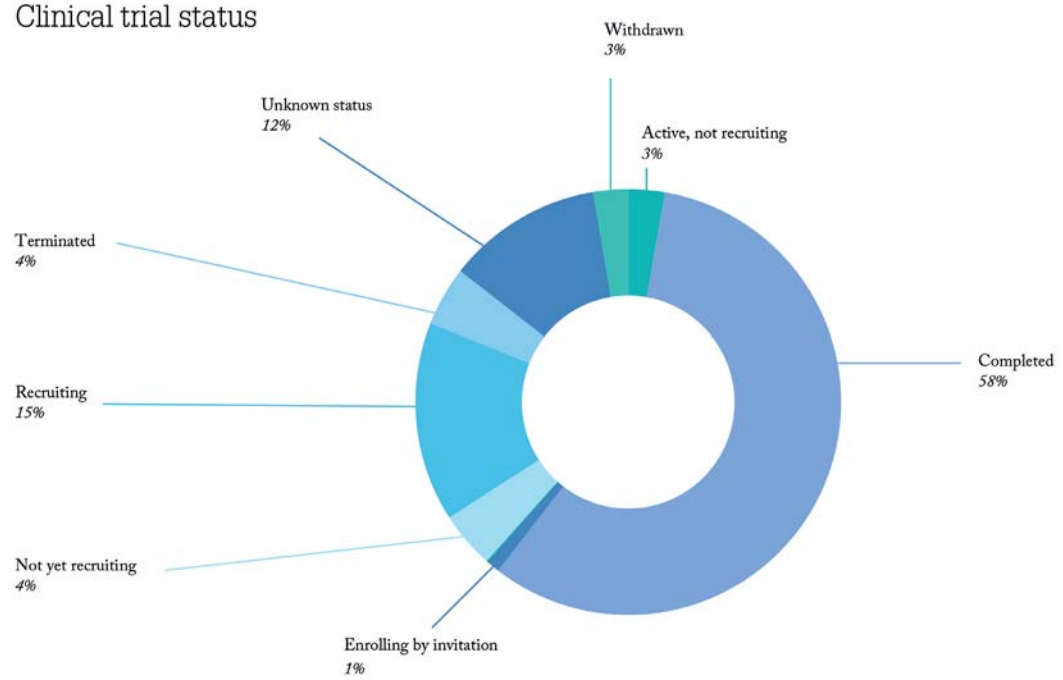
The cornea is no stranger to innovation and research – an incredible amount of time, effort and money has been invested in refractive surgery R&D over the years, and such procedures are almost uniformly safe and successful. But there's more to the cornea than being a refractive surface that's ripe for ablation – it's the site of many diseases, from ocular surface disorders to endothelial dystrophies and everything in between. Treatment strategies span everything from excimer and femtosecond laser interventions, UV illumination combined with riboflavin application, stem cells, to even the topical administration fungal isolates like ciclosporin.

So what's next? To find out where clinical research into dry eye has been focused, and where ongoing clinical trials might take the field, we performed an analysis of dry eye clinical trials on clinicaltrials.gov.

We searched clinicaltrials.gov for: "cornea," and analyzed the data in Microsoft Excel 2013. Inappropriate records were excluded, and the full text of each record examined for additional details to be recorded into the spreadsheet.



Clinical trial status



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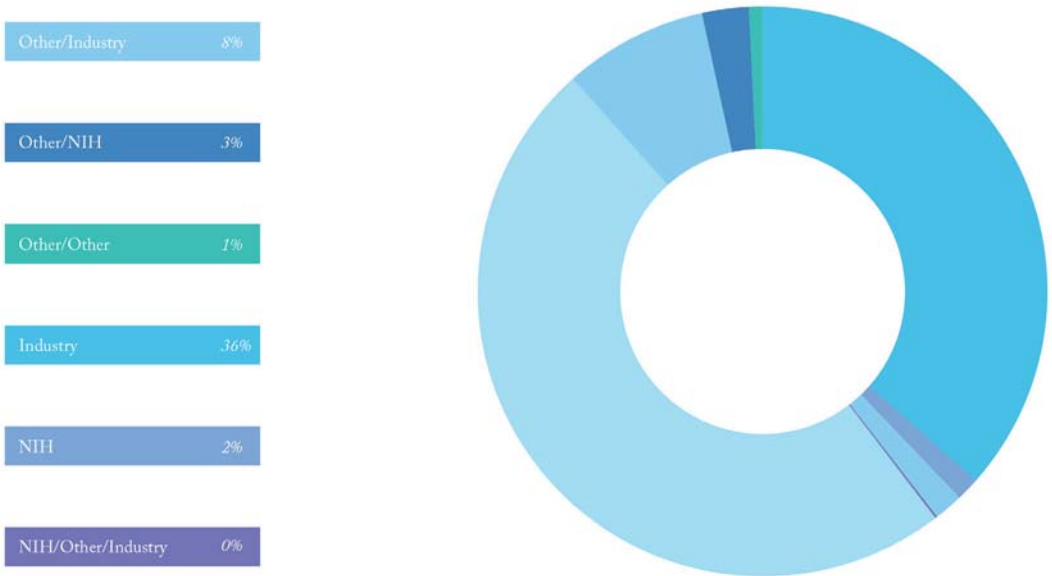

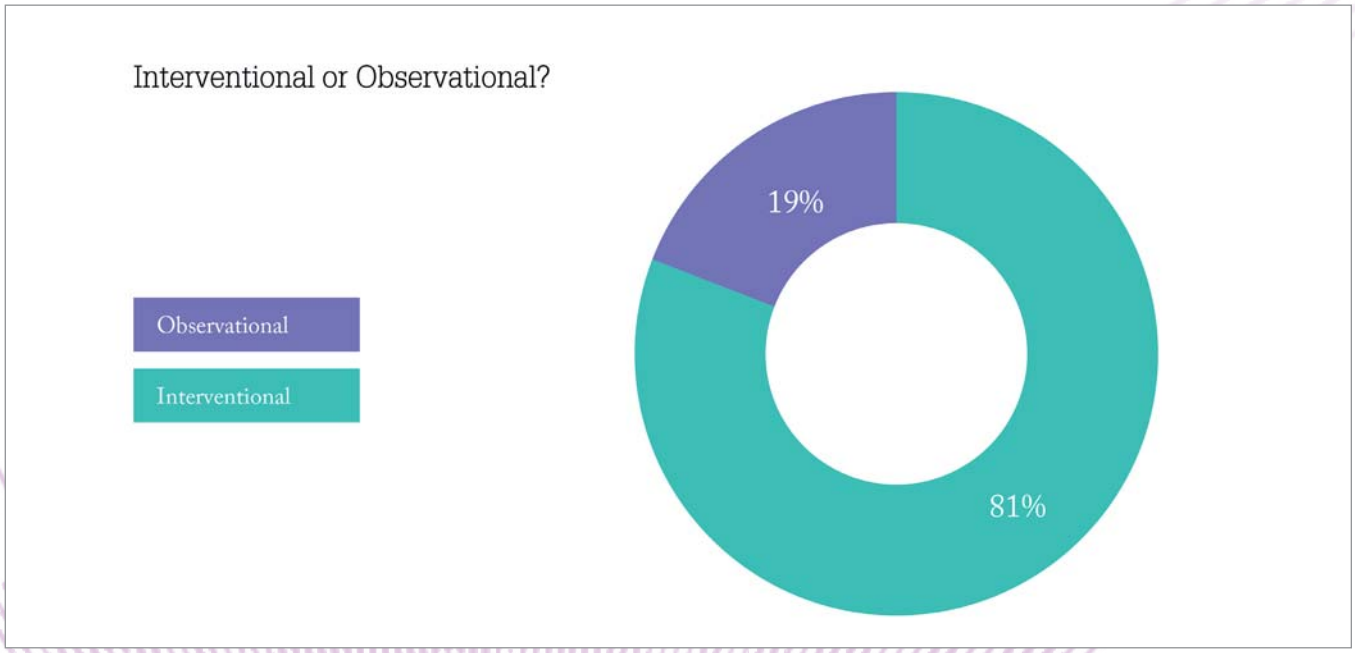
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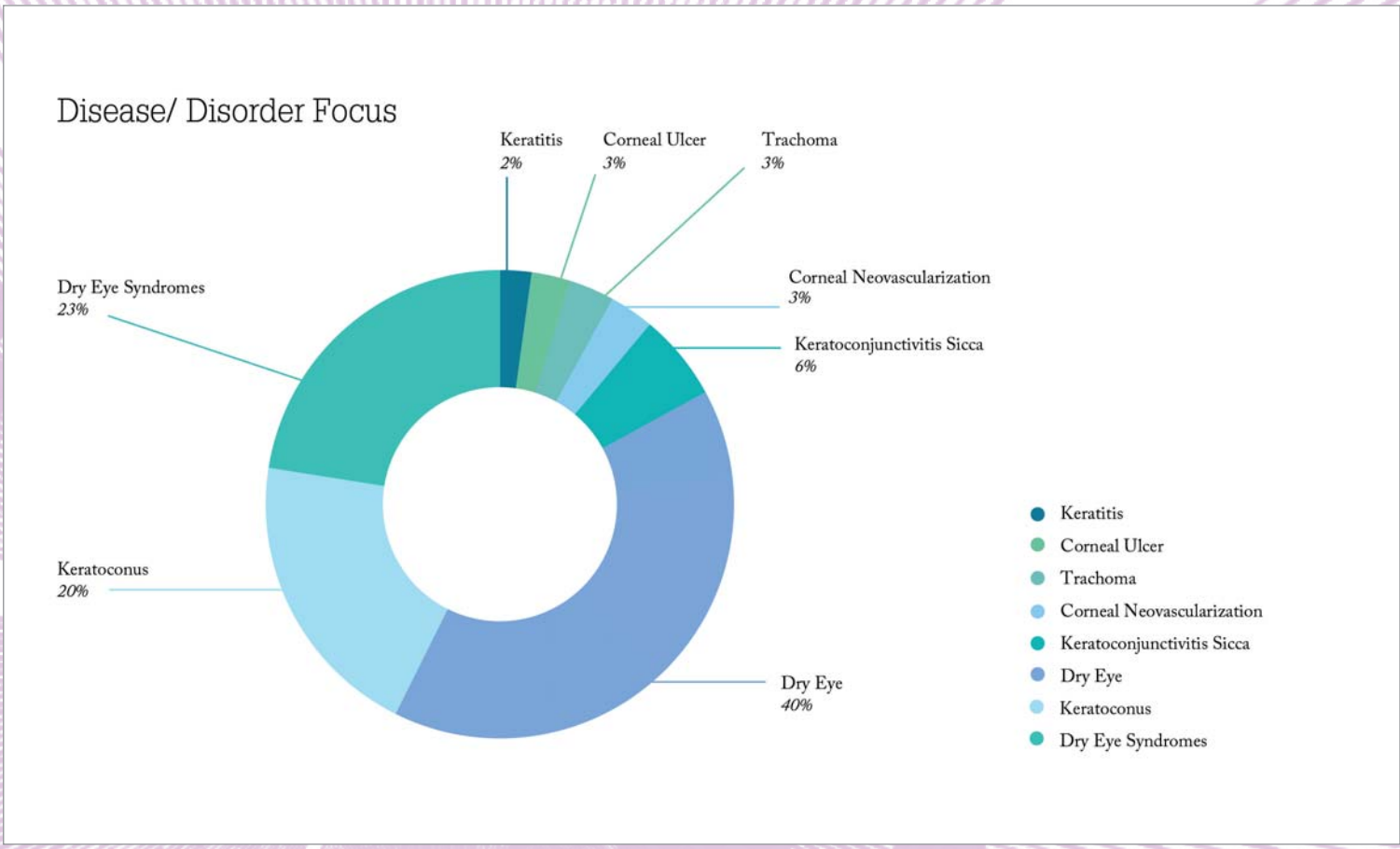
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Corneal Ulcer
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Trachoma
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Dry Eye Syndromes
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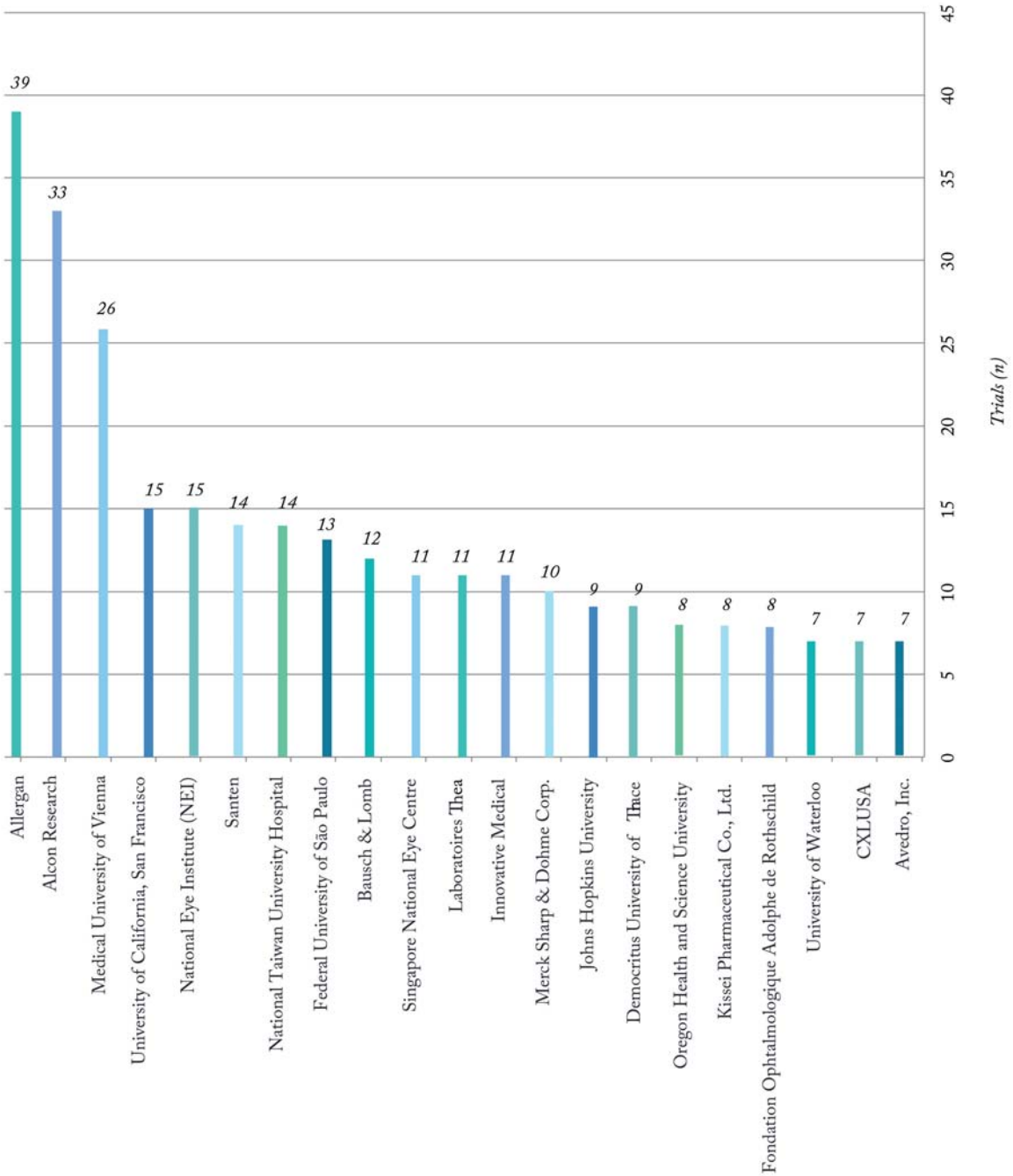

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Addressing Needs Beyond Disease

Ophthalmologists can do a great deal to help meet the needs of patients with low vision… And it only requires one initial question

By John D. Shepherd

Three years out of residency as a comprehensive ophthalmologist, I developed severe back pain shortly followed by a knee injury. After years of seeing several different medical professionals, trying numerous different pain medications – as well as months of physical therapy and two operations – I was still in a lot of pain. And I was struggling. My work schedule had been interrupted so many times that I had to make the ultimate decision – for both my own and my practice's sake – to stop doing surgery. It was the most difficult decision I have ever had to make. Imagine being an early career ophthalmologist again, and consider how you would feel!

What I didn't realize, was that it would fuel an identity crisis. I found myself asking, "What is an eye surgeon that doesn't do surgery?" Combined with the activities I could no longer do – or enjoy – at home, I felt like I was living a less-than-normal existence. I felt a tremendous sense of abandonment, and ended up being treated for two years as an outpatient for depression. It was a very dark chapter in my life. But why am I telling you this? Because I believe my story can help fellow ophthalmologists understand what their patients with irreversible vision loss might be going through.

An epiphany

When a cure exists, patients don't tend to be labored by thoughts of what they can no longer do; once the problem is solved, they can return to their normal routine. But when pain or symptoms persist, and there is no cure, the activities that are no longer possible become increasingly noticeable. Going about daily life becomes a continual struggle. Such patients need to learn to live with their condition. Are there ways to live with chronic pain? Yes – that's what pain management clinics are all about. There are exercises that can be done and approaches that can be taken to minimize the disability; in short, there is a way to move forwards. But no

At a Glance

- *I am a low vision rehabilitation specialist, but I started my career as a comprehensive ophthalmologist*
- *I'd like to share the story of my transition into my current career, as I believe it can help ophthalmologists address what other care patients might need*
- *It isn't all about the eye and the disease; many patients with irreversible vision loss also suffer a psychological impact*
- *We must best address the current needs of patients, as well as what the future may hold.*

physician during my treatment journey had ever mentioned this option to me, nor addressed the issue of how I could live with my condition.

"Patients still have to live with the blurred vision that is making their day-to-day life difficult."

Going back to my career, I became a medical ophthalmologist by default. And I had an epiphany. When taking care of patients with AMD, I recognized similarities to what I had been through. But instead of back and knee pain, their symptoms were blurred and impaired vision. After months of dealing with their visual symptoms, these patients were realizing all the things they could no longer do: reading, driving, even recognizing their children's faces... But did I ask them if they were struggling with any of their activities? No – because I was looking at the eye and not them. Our patients might receive medical and surgical treatments, the best glasses, eye vitamins to help slow the disease progression, and so on, but none of these things are a cure. These patients still have to live with the blurred vision that is making their day-to-day life difficult. Just as the physicians who took care of me were insensitive to the realities of living with chronic pain, I started to realize that I was being insensitive to my patients who were living with the reality of irreversible vision loss.

After my epiphany, I asked myself whether patients with irreversible vision loss get depressed. And they do; two studies have demonstrated that around 30 percent of patients with AMD have depression (1, 2), and the incidence of depression and anxiety is higher in patients with visual impairment compared with the general population (3).

But there is help available for patients with irreversible vision loss – low vision rehabilitation. Many ophthalmologists may think that low vision rehabilitation is all about magnifiers, but it is so much more than that.

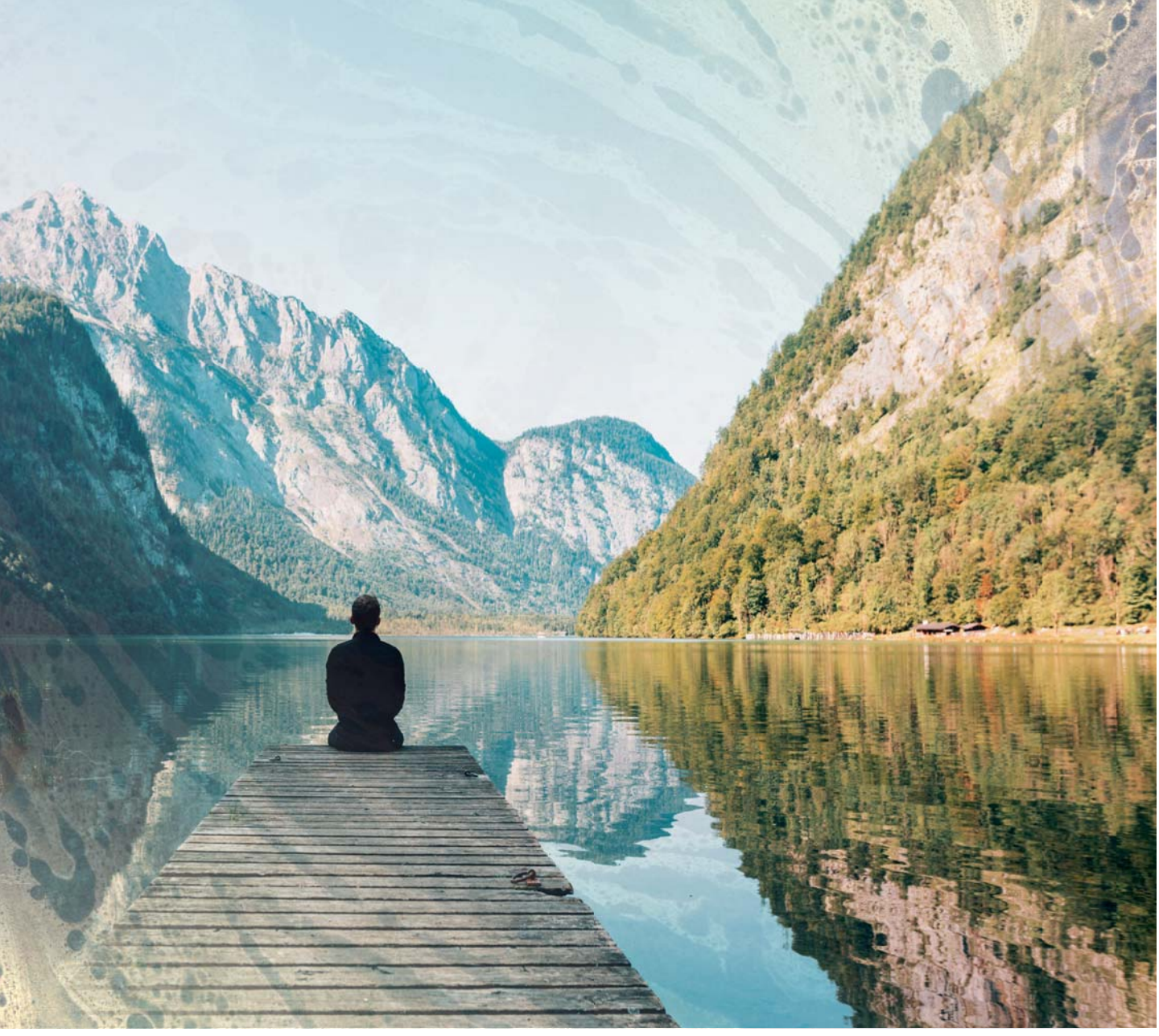
Looking beyond the disease

Low vision rehabilitation is the branch of care concerned with providing the necessary optical devices, visual skillstraining, environmental adaptations and counseling to minimize vision-related disability when no restorative process is possible. Through assessing functional history we learn what impairments patients are experiencing in their daily activities – such as managing finances, working in the kitchen or hobbies – and look at how patients can minimize their disability so that they can resume those activities. It can be something as simple as using their vision in a different way, or using optical devices or apps for assistance. The number one reason patients come to see a low vision specialist is because of problems with reading, but because many patients have scotomas, simply making the print larger doesn't solve the problem. Specially-trained occupational therapists can work with patients to provide scotoma-compensating strategies, so that they might navigate those areas and minimize the interference.

Assessing depression is also an important aspect of our care. Although most clinicians recognize that psychiatric medication and counseling can be helpful for patients suffering with depression, low vision rehabilitation itself has been found to help prevent depression in patients with low vision (4). It can be difficult, however, to recognize depression in patients, which is why it is often missed. Patients often get frustrated at irreversible vision loss because they may not be able to do things, but depression is very different to frustration. A depressed patient is more likely to withdraw, and upon examination it can be difficult to identify they are depressed unless you are specifically looking for it. This is where the environment of the low rehabilitation specialist is key, as we can identify the problem, address the patient's visual impairment and get them into the hands of others who can address the mental health aspects.

"Low vision rehabilitation has been found to help prevent depression in patients with low vision."

But despite the benefits of low vision rehabilitation, low numbers of patients are being referred – under 15 percent. Why? Perhaps it is a combination of a lack of patient and physician awareness of the available help, as well as the increasing demands upon eyecare providers. It could also be because low vision rehabilitation is an area that needs to be grown and developed. A change is needed, and I



think that ophthalmologists have an important role to play; ultimately, that role will be born out of a discussion about how we as an eyecare community can address the issue.

The road ahead

The key point I really want to share with ophthalmologists is that if we place all our attention on managing an incurable disease then we risk overlooking the importance of managing the impairments caused by the disease. Over the next 30 years, we're facing an increased prevalence of impaired vision (5), and we must be better equipped to address patient needs.

I presently serve as Chair of the AAO Vision Rehabilitation Committee, which among other activities raises awareness of vision rehabilitation issues at meetings. However, ophthalmologists attend meetings to learn the latest research, procedures and techniques, and their mind is not on addressing the impairment in their patients. But if David W. Parke II, the CEO of the AAO, is behind the issue, shouldn't more ophthalmologists join him?

Like most ophthalmologists, I wasn't aware of the issue when I was in residency training. But, in my view, it shouldn't take what I went through to recognize that we need to do something about this. The Vision Rehabilitation Committee is currently assessing how our residents are taught, and whether they are being provided with resource materials on assessing impairment – this is key.

When I embarked on my career I never had any desire of being a low vision specialist – it wasn't my area of expertise. But a life transition called me to explore the area, and I realized how underserved and challenging it is. I am highly passionate and motivated because it ties

What Can I Do?

Identify those at need

- If you have a patient in your practice who has permanent vision loss (BCVA 20/40 or 20/50 or worse) you – or your technician – need to ask one question. *"Does your vision loss make it difficult for you to participate in your day-to-day activities?"* If at that point they answer "yes," and the 'floodgates' open and they start to talk about what they are no longer able to do, you need to get them in the hands of someone who will address the impairment. These patients need to understand that while there is no present cure for their vision loss, there are ways to manage the impact caused by the impairment.

Recognize depression

- If patients answer the one question with a "yes" then ophthalmologists should refer them to a low vision specialist. Many low vision specialists screen for depression in their patients. There are many available depression screening tests and some are as simple as two questions. When a patient shows elevated results for depressive symptoms, it prompts a supportive conversation to let them know how common depression is with low vision and emphasizing what can be done to help them.

Avoid the dreaded 'B' word

- I encourage all ophthalmologists to tell their patients with AMD that they will never lose all of their eyesight. People need to know there is always going to be vision they can use – throwing out the 'B' word doesn't offer hope or encouragement because it doesn't suggest how to move forwards. It is more valuable to tell them that they will retain some vision rather than saying they'll go blind.
- It is always best to stress what can be done, rather than what cannot:
- "You will never go blind"
- "There is a lot that can be done to improve your quality of life"
- "You are much more than your disease"
- Share success stories of individuals living full lives despite vision loss

Refer to external sources

- There are plenty of external sources available to guide you with helping – or finding help – for patients who need it. There is a good listing of such resources on the AAO website (aao.org) by entering "low vision resources" in the search bar.
- The AAO's Vision Rehabilitation Committee has created a short video titled "There is something you can do" (available at: http://bit.ly/AAOVision). As David W. Parke II says in the video: "Vision rehabilitation is now the standard of care for patients who are losing their vision. This is something that all of us as ophthalmologists should keep in mind every day in our offices."

in with the difficulties I experienced with totally different symptoms. Although we have a long journey ahead, we're making inroads, and I am optimistic we can meet the needs of this increasing patient population over the next few decades.

Our care for patients must go further; we must look at the person behind the eye and resolve to never forget the impairments that can be caused by their disease. As Sir William Osler – one of the founding physicians of Johns Hopkins Hospital, Baltimore – once said, "The good physician treats the disease; the great physician treats the patient who has the disease."

By John D. Shepherd, Director of the Weigel Williamson Center for Visual Rehabilitation and Assistant Professor of Ophthalmology at the University of Nebraska Medical Center in Omaha, USA.

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Always for the Greater Good

Sitting Down With…
Monty Montoya,
CEO of SightLife Surgical

What got you into the world of eye banking?

In college, my wife and I decided we needed jobs, and she found an eye recovery technician job for me at the Arizona Lions Eye Bank. I interviewed for it the day before our wedding, and came back from honeymoon to find out that I had got it. I spent the final year of my course recovering corneas and preparing them for transplant. I actually ended up working there for a couple of years before leaving to help set up an eye bank at the Donor Network of Arizona.

How did you find yourself at SightLife?

In 1997, whilst Director of Eye Bank Operations for the Donor Network of Arizona, I had the opportunity to join the Northwest Lions Eyebank, which was serving Washington, Northern Idaho and Alaska. (There's a backstory here: my wife is from Seattle, and my very crafty mother-in-law always managed to introduce me to people in Seattle to ensure that I was receiving a fairly regular stream of job offers!)

It was quite a challenging experience in the beginning. The organization was in very bad financial shape – within a couple of weeks of working there I was asked if I could wait to receive my paycheck as they didn't have the cash! That was when I began to appreciate the importance of running non-profit organizations like a business – if we really tapped into the best business and management techniques, then we could stay in business as well as help a lot more people. When I joined in 1997, we were responsible for about 700–800 corneas a year. By applying business tactics, we were providing over 2,000 corneas a year in 2000, and had become the number one provider of corneas for transplant in the US – and the world.

What inspired SightLife Surgical?

In 2014, we decided to test our mission of eliminating corneal blindness by 2040. An outside group revealed we were working at a 250-year pace! It was a punch to the gut. But it ultimately led to the creation of SightLife Surgical. I realized that as a non-profit organization, we would never be able to generate the financial or human resources to reach our goal. But if we tapped into investment resources that could drive innovation, we could use the profit to drive education and provide more access to sight-restoring treatments. I have made the transition from being a non-profit guy all my life to being the CEO for a for-profit company.

"I wish I had appreciated much earlier in my career the impact that partnering with the commercial sector could have."

How has that transition been?

Very interesting! Although quite sad in a way, as I have learned that many people in the non-profit academic world see themselves as 'holier than thou' and look down on people in industry or the commercial space. But blending academia, non-profits, for-profits and government is really what is going to drive solutions. If we all stay divided in our silos, we won't be able to deliver the full benefit of what we could by working together. With SightLife Surgical, we are doing things that have never been done before. We've been able to advance Shigeru Kinoshita's work on injectable endothelial cells, and we have the resources to get it through the regulatory hurdles; we couldn't have done this as a non-profit. I wish I had appreciated much earlier in my career the impact that partnering with the commercial sector could have – we might have been 10 or 15 years further on.

Notable challenges?

I remember being in China in 2000 with eight corneas – and 150 patients showed up. It was overwhelming, and made me realize how much more we had to do. Such situations are always challenging.

Right now, I find it hard when long-time friends and colleagues become very critical; I have even been 'un-friended' by some people in the eye banking world. Why? Because we stepped into an arena where we can gain investment to drive innovation. Some people see it as an indication that I am personally not committed to the mission – like I have gone to the 'dark side.' But that couldn't be further from the truth. It's about accepting the harsh reality.

What are the highs of your career?

One high point is feeling incredibly blessed to be in a position to really effect change in global health. Another high point was in 2014, when SightLife was recognized with the Entrepreneur Award by Ernst and Young. It was a huge validation of what we've been doing.

I would have to say that the unsung hero in all of this is my wife. I have done all this stuff, and it has been a huge commitment of time and energy, but I wouldn't have been able to do it without her support.

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