36th Congress of the ESCRS

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Sunday 23 September 2018
18.15 - 19.15

2 Minutes to Enhanced IOL Experience!
Debating the topics most important to your practice

Reed Messe Congress Centre
Room Strauss 3
Vienna, Austria
2 Minutes to Enhanced IOL Experience!

Debating the topics most important to your practice

Sunday 23 September 2018
18.15 - 19.15

Moderators
Antoine Brezin (France)
Saleh Al-Messabi (United Arab Emirates)

Introduction
Antoine Brezin (France) & Saleh Al-Messabi (United Arab Emirates)

The ultimate control in IOL delivery
Thomas Kohnen (Germany)

Ensuring refractive stability: the AcrySof® heritage
Oliver Findl (Austria)

Advantages of a new BioMaterial and a new edge profile
Nic Reus (Netherlands)

10 years later - is astigmatism treatment the standard or still just an option?
Larry Benjamin (United Kingdom)

Q&A and conclusions
Antoine Brezin (France) & Saleh Al-Messabi (United Arab Emirates)

Room Strauss 3
Reed Messe Congress Centre - Vienna, Austria

36th Congress of the ESCRS
ESCRS Preview
Make the most of your time at the ESCRS with our show preview

Dense cataracts
Could OCT-based biometers better serve cataract patients?

Eye care in Cambodia
How some ophthalmologists have volunteered their expertise abroad

Lamellar holes
How to identify eyes that are likely to benefit from surgery

GLAUCOMA

Optic disc photography
Device appears to overcome obstacles in traditional stereoscopic photography

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Dealing with discontented patients
Could refractive-index shaping help shape and manage high expectations?

By Prof. Burkhard Dick
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Prof. Dick is director and chairman at the University Eye Hospital, Bochum, Germany. Prof. Dick is a member of the Ophthalmology Times Europe Editorial Advisory Board.

S
ometimes, a little background music helps one to come to grips with one’s feelings. Whilst I was thinking of a particular patient one day, the juke box in my brain started playing Cher’s 1980s hit ‘If I could turn back time’.

If I had been able to turn the clock back just a couple of weeks earlier, I would have recommended to the 50-something year-old patient, after the initial examination, to go somewhere else, maybe to one of the (very) few colleagues I am not on the best terms with and have that surgeon implant those trifocal IOLs. But time travel being a dream, I undertook the procedure myself and was now facing the consequences.

His vision was 20/20, the IOL could not have been better positioned and there was, two days after the operation of the second eye, not the slightest hint of inflammation. But the patient was, as I now learned, a born complainer – the slight haze really bothered him and the intermediate vision was not as he had hoped it would be. I told myself that a person with such a mentality would probably have been better served with monofocal IOLs (mIOLs). But of course, it was too late.

At least I could counter his complaining over the money he had spent. I showed him the newspaper I had kept, reporting that the United States FDA had approved a gene therapy for the treatment of relatively rare inherited disease – the effects being that the patients were, in some cases, able to put away their navigational canes and recognise the faces of loved ones again.

The price tag was a whopping $850,000 for a one-time treatment. It at least allayed the financial aspect of his discontent.

Reversing the result of an operation has, over the long course of medical history, mostly been tainted by the feeling of failure on the part of the physician. However, in 21st century ophthalmology, with a large segment of the population more demanding than ever before (particularly those interested in refractive surgery), doing some revision or re-adjustment of an earlier intervention is no longer—fortunately—an admission that something went wrong.

In 21st century ophthalmology, a large segment of the population are more demanding than ever before.

It is, rather, a tribute to the sometimes overly high expectations we have to meet – when, for instance, a three-quarter diopter beyond the target refraction is a serious problem, or the challenges of a mIOL turn out to be greater than anticipated. Therefore, it is another milestone in the already breath-taking development of current ophthalmology when postoperative corrections and adjustments become part of our service portfolio.

A couple of years ago, we began implanting light-adjustable IOLs and had satisfying results in patients who were a bit off the desired refractive status. Now, our hopes rest on a new concept, in large part due to the endeavours of Professor Josef Bille and his admirable sense of innovation: refractive index shaping (RIS); if it works in clinical practice as it has so far in experiments, it will not only enable the surgeon to add or detract from the refractive power of an implanted IOL, but also change a multifocal optic into a monofocal, if need be – and back again, if the complaining never stops.

Such readjustments have the potential to satisfy even the most critical patient, maybe even my complainer-in-chief. And the fitting tune to celebrate this development when facing a discontented patient might be Guns N’ Roses’ ‘November Rain’: Nothin’ lasts forever, and we both know hearts can change...
A meeting of minds expected again as 36th Congress of ESCRS looms

By Caroline Richards

The Congress of the European Society of Cataract and Refractive Surgeons (ESCRS), now in its 36th year, is just around the corner, and this time, the Reed Messe in Vienna, Austria, will be hosting the event.

From the 22nd until the 26th September, a variety of symposia, poster sessions, instructional courses and workshops will showcase the latest advancements in ophthalmology, alongside a daily exhibition providing delegates with information on new technologies.

It is becoming something of an expectation that the ESCRS takes place in some of the most interesting cities in Europe, and this year is no exception, with the beautiful Vienna providing attendees with impressive sight-seeing opportunities when they venture out from the congress.

In Ophthalmology Times Europe’s exclusive preview of the ESCRS, we have asked two of our respected Editorial Advisory Board members, Professor Jorge L. Alió, chairman of ophthalmology at Vissum in Alkante, Spain, and Professor Albert Augustin, professor of ophthalmology and chairman of the Department of Ophthalmology at the Klinikum Karlsruhe, Germany, to provide their input on the sessions. Read on to find out more!

**Saturday 22nd September**

**Clinical Research Symposia**

8.30am-5.30pm

The first symposium on Saturday will be on the topic of myopia. Chairpersons Prof. Oliver Findl of Austria and Dr Rudy Nuijts from the Netherlands will host presentations that will delve into epidemiology, genetics, biological mechanisms and scleral cross-linking, among other subject areas. Prof. Augustin notes the “very high quality of the moderators and speakers” in this session,
which he believes will guarantee high-level science and clinical relevance.

Prof. Alió also comments on the topic: “Myopia is one of the top topics today, worldwide, due to the emergence of a immense increase in the epidemiology of this problem. Myopia should not be considered always to be a disease but rather only in exceptional cases. However, it draws the attention of society because it limits the activities of those people who cannot use spectacles (including security forces, and port and professional dedications); it has a mysterious genetic background; and it has no treatment other than the correction of the refractive error by refractive surgery. This symposium promises to be one of the most interesting as myopia affects, in Europe, over 30% of the population, and in other countries like Israel and the Far East, over 50%.”

‘Measuring Near and Intermediate Quality of Vision’ will be the theme of the second morning/early afternoon symposium, which will be chaired by Dr Béatrice Cochener from France and Dr Nino Hirnschall, Austria. Topics discussed will include assessing reading patterns, and methods for quantifying various factors such as halos and accommodation, all of which are “very important for your daily clinical routine”, remarks Prof. Augustin.

Prof. Alió notes that “most studies on visual outcomes have been focused on refraction and best corrected visual acuity”, explaining that quality of vision also relates to a person’s perception about their vision: “These psychological issues are still difficult to measure and are the subject of this symposium.”

He believes this will be a leading topic in the future: “As a surgeon, I consider most important the adequate quality rather than quantity of vision because nobody complains about quantity, but we have many patients with J1 20/20 syndrome who have good vision but feel negative about their perception of visual quality.”

Dr Thomas Kohnen of Germany and Prof. David Spalton, the UK, will chair the afternoon’s ‘Blue Sky Lens Research’ symposium, featuring a variety of topics from femto lentotomy to stem cell regeneration of the lens. When considering cataracts, Prof. Alió remarks that preventative measures or even therapies could become important in the future “both to delay the appearance of this problem, avoid surgery, or, more importantly, lead to preservation of accommodation for a longer period of time”. The final series of talks will be on ‘Femtosecond Surgery’, from 3.30pm, hosted by Dr Guy Kleinmann of Israel and Dr Mario Nubile, Italy. Overall, Prof. Augustin believes this symposium will touch on many interesting clinical topics.

**Instructional Courses**
**8.30am–6.00pm**
Like last year, a series of free-to-attend instructional courses will be offered throughout ESCR, beginning on Saturday 22nd September; it is not necessary to register for these. Catering for all levels, from basic to intermediate and advanced, the courses aim to inform attendees about all manner of surgical techniques, including microsurgical suturing techniques; vitrectomy and IOL implantation; glaucoma surgery; corneal cross-linking; and phacoemulsification.

Prof. Augustin highly recommends attending as many courses as possible, pointing out the importance of learning from experts in the field, improving skills and avoiding mistakes. Also emphasizing the attractiveness of this “very diverse programme” is Prof. Alió, who advises choosing three or four of the courses according to the topics and directors, in order to find specialised tracks that might
improve the continuous medical education of each doctor on a particular topic.

**Exhibition Hall**
The exhibition schedule will be open from 9am to 5.50pm on Saturday.

**Poster Sessions**
*2pm–4.30pm*
A moderated poster session will be held from 2pm for one hour on Saturday, while presented poster sessions will follow.

**ESCRS/EuCornea Symposium: Corneal Cross-Linking: Current Status and Future Perspectives**
*11am-1pm*
One of the two main symposia on Saturday will focus on the biomechanics of cross-linking, techniques surrounding it, and its use with LASIK and for keratoconus. Dr Roberto Bellucci of Italy and Dr Jesper Hjortdal, Denmark, will chair, and three short discussions will be interspersed throughout. Prof. Alió comments that this symposium will update the attendee on recent advancements on the “many varieties and diverse techniques of crosslinking, some of them with a lack of adequate evidence and some with strong evidence in favour”. Echoing his thoughts, Prof. Augustin states: “Cross linking is still an evolving field and techniques are rapidly changing.”

**ESCRS/EuCornea Symposium: The Diabetic Eye**
*2pm–4pm*
Dr Cochener and Prof. Sebastian Wolfe, Switzerland, will chair the second of Saturday’s main symposia, which will put the spotlight on diabetes treatments, epidemiology of diabetic eye diseases and preparing for cataract surgery, among other topics. Prof. Augustin remarks that the symposium will provide the attendee with “further insight into both anterior and posterior segment alterations incuded by diabetes”. Prof. Alió adds: “The diabetic eye affects a huge amount of people around the world with the complications that are related to this metabolic disease. Diabetic retinopathy is one of the leading causes of blindness worldwide and is still the subject of strong medical actions and wide research leading to its prevention and early detection. Other problems related to the diabetic condition of the patient will be reviewed.”

**Refractive Surgery Didactic Course**
*8.30am–5.30pm*
This course will address a range of subject areas, with chairpersons Dr David Epstein of Switzerland and Dr Jose Guell, Spain, taking the reigns.

**Young Ophthalmologists Programme**
*8.30am–4pm*
Providing an opportunity to ‘learn from the learners’, ophthalmologists at the beginning of their careers will demonstrate what they have learnt through video cases, so this session will be useful to fledgling physicians. The first presentation will address the issue of ‘Preparing for the first operation’, with subsequent video cases focused on biometry; incisions; capsulorhexis; hydrodissection; IOLs ‘tricks’; and phacoemulsification. Taking charge as chairpersons again this year will be Dr Oliver Findl, Italy’s Dr Simonetta Morselli and Dr Kaarina Vannas of Finland. Prof. Augustin notes the “well-known course directors” in this programme. “You can expect a high didactic level, and many tips and tricks for young physicians,” he adds.

‘Myopia is one of the top topics today, worldwide, due to the emergence of an immense increase in the epidemiology of this problem.’

— Prof. Alió

**Sunday 23rd September**

**Ridley Medal Lecture**
*10am–10.50am*
Dr Rudy Nuijts, associate professor of ophthalmology and director of the Cornea Clinic and the Centre for Refractive Surgery at the Department of Ophthalmology, University of Maastricht, the Netherlands, will give a one-off lecture on Sunday morning. The title of his presentation is ‘Facts first!’

Exhibition Hall
The exhibition schedule will be open from 9am until 5.30pm on Sunday.

**Glaucoma for the Cataract Surgeon Symposium**
*11am-1pm*
The main symposium on Sunday will be chaired by Dr Simonetta Morselli and Prof. David Spalton. Topics discussed will be: ‘Imaging aqueous outflow’; ‘Eagle eyes’; ‘Intracanulacicular and suprachoroidal devices’;
The Measure of All Things

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Journal of Cataract and Refractive Surgery Symposium
2pm–4pm
On Sunday afternoon, 'Controversies in Cataract and Refractive Surgery' will be the theme of an informative symposium chaired by Dr Kohnen, the JCRS European Editor, and Dr William Dupps of the USA, the US Associate Editor, both of whom Prof. Augustin remarks are well-known experts in the field of corneal and refractive surgery. Three subject areas will be: 'Intraoperative OCT for the anterior segment', 'Cataract and corneal transplantation' and 'Corneal refractive surgery'. There will be ten-minute discussion periods following each topic. Prof.

Augustin believes it important for all anterior segment surgeons to attend this symposium.

Young Ophthalmologists Session
4pm–6pm
Dr A Panico, Italy, and Dr Filomena Ribeiro, Portugal, will chair a one-off session entitled 'Targeting Emmetropia in Cataract Surgery' on Sunday afternoon, which will address issues to consider before surgery. 'What is emmetropia?'; 'Let’s measure the eye' and 'Choosing the best IOL for each patient' will be among the presentations.

Workshop on Visual Optics
8.00am–5.45pm
In what Prof. Augustin sees as an “interesting format”, this

"Subconjunctival devices'; 'New drugs and slow release devices'; and 'Trabeculectomy revisited'. As with all other symposia throughout ESCRS, discussion opportunities will be present throughout.

Prof. Alió states: “Dealing with the glaucoma and cataract is one of the most conflictive topics that faces the practical surgeon. The different model approaches with mini glaucoma shunts (MIGS), the benefits of cataract surgery over IOP control and the implications of some topical medication in the outcome of cataract surgery will be reviewed. This symposium will be interesting for all cataract surgeons attending the meeting.”
three-part programme will explore ‘Visual Behaviour’ (Part 1), ‘Visual Optics (Part 2)’ and ‘Imaging the Human Eye’ (Part 3). Part 1, moderated by Prof. Raymond Applegate of the USA and Prof. Pablo Artal from Spain, will include a break at 10.40am to allow participants to attend the ESCRS/EUCornea symposium entitled ‘Corneal Cross-Linking: Current Status and Future Perspectives’, which will take place in Hall A1, before the workshop resumes following lunch. Moderators for Part 2 are Dr Ioannis Pallikaris of Greece and Dr Marie-José Tassingnon of Belgium. Overseeing Part 3 will be Drs Damien Gatinel, France, and Dr Pallikaris. Dr Augustin adds that this workshop is important to attend and “highly recommended for all doctors who are interested in optics and physiology”.

‘Cross linking is still an evolving field and techniques are rapidly changing.’
— Prof. Augustin

Extending Depth of Focus
11am–1pm
Monday’s main symposium, chaired by Dr Michael Amon, Austria, and Dr T Kohen, Germany, is entitled ‘Extending Depth of Focus’; optical principles, small apertures and corneal techniques will be among the variety of topics on offer to members of the audience. Prof. Alió comments: “Some lenses and corneal procedures have been trying to implement this type of multifocality, which implies the induction of some aberrations on purpose to increase the ability of the eye to focus. The issue is how much we gain and how much we lose in using these lenses. This symposium will deal with this issue.”

Refractive Surgery for High Ametropia
11am–1pm
During Tuesday’s two-hour main symposium, attendees will be treated to talks on anatomical limitations, the ever-popular SMILE versus LASIK debate and intraocular surgery in short versus long eyes. The chairpersons will be Dr Alex Day, UK, and Dr Jose Guell.

Poster Sessions
Various times
Poster presentations will take place in the morning on Monday, from 9am, and there will be one moderated session at 2pm.

Presbyopia Workshop
2pm–4pm
Following lunch time on Tuesday, attendees can visit the ‘Presbyopia Workshop’, which will include a range of topics, including laser correction, corneal inlays, and the pros and cons of extended depth-of-focus lenses and multifocal IOLs. Switzerland-based Dr David Epstein and Dr I Pallikaris of Greece will be the chairpersons. Presbyopia is “always an interesting topic”, Prof. Augustin says, and will help attendees stay up-to-date in the field of presbyopia correction.

Monday 24th September Exhibition Hall
The exhibition schedule will be open from 9am until 5.30pm on Monday.

Tuesday 25th September Exhibition Hall
The exhibition schedule will be open between 9am and 5pm on Tuesday.
Wednesday 26th September

Best of the Best Review Session
8.30am–10.30am
To round up the meeting, a selection of the most interesting videos and presentations given during the Congress will be reviewed by a panel of physicians, in the ‘Best of the Best’ session on Wednesday morning, which, like last year, will be chaired by Drs Oliver Findl and Boris Malyugin.

The Enigma of Pseudoexfoliation
11am–1pm
What is pseudoexfoliation? The answer to this question will be posed in the first talk of Wednesday’s main symposium, which will also enable attendees to discover more about the epidemiology, genetics, intraoperative complications and other elements of this enigma. Dr David Epstein and Dr Oliver Findl will chair.

“Pseudoexfoliation is still a mystery. So, this lecture is of interest for all anterior segment surgeons and glaucoma specialists as well as glaucoma surgeons,” Prof Augustin comments. Prof. Alió also remarks on pseudoexfoliation’s mysteriousness, a problem that affects many people according to ethnicity and geographical location. “Even though important investigations have been performed, the reasons that lead to this problem, and its implications and prevention strategies are still unknown. This symposium will deal with the basic knowledge about this problem and how to deal with it on practical terms,” he adds.

Video Symposia
On Saturday, Sunday and Monday afternoons, surgical videos will be played, aimed at helping ophthalmologists navigate sticky situations. Saturday’s session is on ‘Challenging Cases’, Sunday’s symposium handles ‘Surgical Complications: You Make the Call’, and on Monday, the topic is ‘Getting Into Trouble’. Prof. Augustin points out that video symposia are a highly recommended format to learn from peers.

Practice Management Masterclass
On Sunday and Monday, Practice Management Masterclasses will be held throughout both days, from 9am to 6pm on the Sunday and from 8am until 6pm on the Monday.

Surgical Skills Training Courses
Hands-on wetlab courses will be available to ESCRS attendees, providing them with the opportunity to practice surgical techniques on porcine eyes. The small classes utilise two-way audio and video as teaching tools.

The cost for all wetlabs for trainees is fixed at 100 Euros per course. For regular delegates the cost will vary between 100 and 150. Some of the course topics this year are: ‘Basic Phacoemulsification’, ‘Basic Suturing Techniques’, ‘Boston Keratoprosthesis’, ‘Corneal Cross-Linking Therapy’, ‘Glaucoma Canaloplasty’; and ‘Modern MIGS techniques enhancing Schlemm’s Canal’. Pre-booking online is necessary.
Refractive cataract surgery has advanced at a monumental pace, bringing high patient expectations, more frequent procedures and higher disease severity. Even with advanced IOLs and techniques, optimal clinical outcomes for patients depend largely on precision planning, which is facilitated by ocular biometer devices.

These instruments provide surgeons with valuable biometry and keratometry parameters that can be plugged into formulae for accurately calculating IOL power. Pinpoint measurements have been shown to be essential for postoperative visual acuity, with even minor errors translating to notable postoperative refractive error.

Current biometric paradigm

Multiple options for performing biometric measurements are available, with varying technical modalities for determining the spectrum of essential parameters. For example, the IOLMaster 500 (Carl Zeiss Meditec) utilises partial coherence interferometry via a 780-nm infrared laser diode and lateral slit illumination for measuring anterior chamber parameters. Another instrument, the Lenstar LS900 (Haag-Streit) employs optical low-coherence reflectometry via an 820-nm superluminescent diode to measure all axial parameters.

Although the precision of these older devices is well established in the literature, they fall short in performing axial calculations in more severely cataractous lenses. Both dense nuclear and posterior subcapsular cataracts are prone to light scattering, resulting in significant signal attenuation from the retina.

The next wave of biometry

New biometers have been developed in an attempt to better serve patients with severe cases of cataractous disease. We now have several years of experience with one such biometer, the ARGOS (Movu Inc.). Unlike older technology, this device utilises a 1060-nm wavelength and 20-nm swept-source technology to perform two-dimensional, full-eye optical coherence tomography (OCT).

This allows for comprehensive measurement of standard axial parameters, central corneal and lens thickness, pupil size and aqueous humour depth. In addition, a ring LED allows for keratometry.

Furthermore, the device utilises a safeguard system for patients unable to correctly fixate their vision during collection: a panoramic view of the eye facilitates alignment with the centre of the pupil, mitigating initial measurement errors. In addition, the system is designed to alert the user in the case of ongoing misalignment, allowing manual adjustment in particularly difficult cases.

But how does this technology benefit the patients previously mentioned, those with mature, dense, difficult-to-measure cataracts? In our experience the ARGOS far surpasses current modalities in measuring axial length in eyes with dense cataracts.

We have successfully performed measurements in many cases that would have been impossible with older devices. Our experience includes successful and accurate measurements in patients with significant posterior subcapsular changes, late-stage cataracts.

IN SHORT

- **OCT-based biometers like the ARGOS allow for accurate measurement of very dense lenses in cataractous patients.**

By Ms Akeno Tamaoki, Dr Noemi Misuraca and Dr Carmela Palmisano

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**Improving clinical outcomes for patients with dense cataracts**

OCT-based biometers are making more accurate axial measurements possible.
cortical changes and the highest severity of nuclear sclerosis.

With this biometer, axial length is truer to the absolute distance, as two-dimensional full-eye imaging allows for inclusion of characteristics that affect axial length but were previously unaccounted for, such as lens thickness. The device also uses the appropriate refractive index (based on research and consensus) for the respective ocular elements, eliminating the need for nomograms that “correct” the axial length for significantly short or long eyes.

Additionally, the OCT employs a wide-scanning beam able to travel beyond the region of the cataract, so that retinal signals are no longer attenuated. The increased wavelength facilitates deeper penetration of the cataract, removing a lot of the guesswork that went into determining accurate IOL power calculations for these patients. With this technology, we have personally measured axial length as long as 33.33 mm (Figure 1).

REFERENCES
Challenging refractive cases require careful analysis and detective work, believes Dr Sonia H. Yoo, professor of ophthalmology and associate director, Bascom Palmer Eye Institute, University of Miami Miller School of Medicine, Miami, United States.

She described the case of a 36-year-old male patient who was referred to Dr Yoo after planned LASIK that was aborted during the procedure. He was referred to have phototherapeutic keratectomy (PTK). The patient had a best spectacle-corrected visual acuity of 20/50.

Dr Yoo thought about use of a rigid gas-permeable (RGP) contact lens but was told the patient could not use it. This led her to think of other ways to diagnose the worsening vision. “Whenever you have a patient with a scar, it’s important to know if the loss of vision is from irregular astigmatism or from the opacity itself,” she said. “A rigid gas-permeable contact lens can help you sort that out.”

If the patient’s vision improves, then you know the problem was from an irregular...

**IN SHORT**

A patient referred for a planned PTK had to have lamellar anterior keratoplasty for worsening vision.

36-year-old male patient was referred for a PTK after an aborted LASIK procedure. Dr Sonia H. Yoo performed an unexpected anterior lamellar keratoplasty, which improved his vision to 20/20 postoperatively. Shown here is the flap amputation with PTK during the procedure. (Images courtesy of Dr Sonia H. Yoo)
surface. If it does not improve, then the problem is likely caused by opacity, Dr Yoo explained.

Weighing up the options
As the patient was intolerant of a RGP lens, Dr Yoo thought about options, which included, firstly, performing PTK with the use of mitomycin C (MMC) but going deep enough to remove the scar, to make the donor lenticule and the diameter. This will match the recipient lenticule I want to remove from the eye.”

Irregular beds call for PTK, MMC
If there’s an irregular bed, PTK and MMC can be used as well, she added.
She likes to use MMC 0.02% for 1 to 2 minutes.

“Whenever you have a patient with a scar, it’s important to know if the loss of vision is from irregular astigmatism or from the opacity itself.

- Dr Sonia H. Yoo

secondly, lamellar keratoplasty and thirdly, flap amputation.
Spectral-domain OCT showed an incomplete flap and epithelium that was not only on the surface but also underneath the aborted flap.
“The reason the vision continued to get worse was that there was flap melt and then more induced irregular astigmatism,” Dr Yoo said.

The other thing that OCT revealed was a thick cornea of 600 μm. The section in question was 100 μm. “We still had 500 μm more to work with,” she said.

Dr Yoo decided to perform a femtosecond-assisted anterior lamellar keratoplasty. She explained her technique.

“In this case, I left the recipient without a donor lenticule because I had 500 μm left,” she said. “If I had needed to place a donor lenticule, I could have used a cornea mounted on an anterior chamber maintainer or a whole globe. It turns out that these caps are refractively neutral.”

Dr Yoo also noted that the advantage of having a donor lenticule is to be able to go back later and either lift it and ablate more tissue or ablate on the surface in the future to correct residual ametropia.

The patient’s vision improved to 20/20 postoperatively, and OCT showed improved surface regularity.

“Whenever you have a patient with a scar, it’s important to know if the loss of vision is from irregular astigmatism or from the opacity itself.

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An extensive analysis of data garnered from the Fight Retinal Blindness (FRB) Project indicated that the treat-and-extend regimens used to manage patients with neovascular age-related macular degeneration (AMD) are reliable alternative approaches that achieve good outcomes compared with monthly and as-needed regimens.

**Observational study**

In this large database observational study—in which patients were in the maintenance phase of treatment with anti-vascular endothelial growth factor (VEGF) drugs—the mean visual acuity level was maintained and the median interval of injections gradually increased to about 2 months after the first year of the treat-and-extend regimens. Reactivation of the AMD lesions occurred most often at about 8 weeks.

Dr Mark C. Gillies, who presented the study data on behalf of the FRB project, explained that the treat-and-extend regimen was defined as administration of monthly treatment until the lesions became inactive; stepwise extension of the treatment interval when the lesion was inactive; and reduction of the treatment interval when the lesion became active.

The rationale for treat-and-extend regimens was based on previous observational studies that reported good outcomes with fewer injections of anti-VEGF drugs, said Dr Gillies, professor, Department of Clinical Ophthalmology, The University of Sydney, and director, Macula Research Group, The Save Sight Institute, Sydney Medical School, University of Sydney, Australia.

**Study describes protocol segments**

Study investigators sought to describe the treatment patterns, disease activity and visual outcomes during the maintenance phase of the treat-and-extend protocol and to compare the primary outcomes between eyes with short induction times, defined as three or fewer injections of anti-VEGF drugs that achieved lesion inactivation, and eyes with long induction times.

The maintenance phase was defined as starting from the first visit that the practitioner graded the neovascular lesion as inactive, Dr Gillies explained.

The study, published in Ophthalmology (2016;123:2393–2400), included 2,096 eyes of 1,698

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**DECREASE IN LETTERS**

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<th>Letters</th>
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<td><strong>Overall</strong></td>
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<td><strong>Short induction eyes</strong></td>
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<tr>
<td><strong>Long induction eyes</strong></td>
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‘The long-induction eyes reactivated sooner than the short-induction eyes.’

— Dr Mark C. Gillies

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**IN SHORT**

- Extensive data from the FRB Project show that treat-and-extend regimens are reliable alternative AMD approaches that achieve good outcomes compared with monthly and as-needed treatments.
patients who were managed with a treat-and-extend regimen out of 6,269 eyes in the FRB database. All eyes had been followed for a minimum of 12 months from the first grading of lesion inactivity. Patients were excluded from the study if they had persistently active lesions.

The rationale for treat-and-extend regimens was based on previous observational studies.

Dr Gillies reported that about 50% of eyes were treated at intervals of 8 or fewer weeks at the 3-year time point. The median interval when the eyes became stable was about 1 year into the maintenance phase.

Visual acuity outcomes
Importantly, the visual acuity was maintained during the maintenance period. The mean change from baseline at the start of the maintenance phase was an increase of 4.3 letters.

The mean change in the visual acuity 3 years after the start of the maintenance phase was an overall decrease of 1.5 letters. In the eyes with a short induction time, the visual acuity decreased by 0.5 letters, compared with a decrease of 3.6 letters in the eyes with a long induction time, according to Dr Gillies.

One-year out
The data analysis also showed that 50% of eyes had lesions that reactivated with the first year of the maintenance period, with the most frequent time to reactivation at 8 weeks. This occurred in 17.4% of eyes.

“The long-induction eyes reactivated sooner than the short-induction eyes,” Dr Gillies said.

When considering the risk of recurrence of the first lesion, the study found “the risk of reactivation by visit increased with increasing interval, increasing substantially beyond 12 weeks and reaching 36.5% if the interval was 20 weeks or more from the previous injections,” Dr Gillies said.

RISK results
At 16 weeks, the risk of reactivation was 5.6% compared with 15.6% at 20 weeks. Eyes with a longer induction phase had worse visual outcomes in the maintenance phase, and earlier and more frequent disease reactivation, although they received injections less frequently, according to Dr Gillies.

The data analysis showed that 50% of eyes had lesions that reactivated with the first year of the maintenance period.

The rationale for treat-and-extend regimens was based on previous observational studies.
CASE OF THE MONTH

SMILE monovision – an effective and safe treatment for presbyopic ametropic patients

Jakob Siedlecki, MD

CASE HISTORY

A 53-year-old woman presented to the SMILE Eyes Clinic Linz, Austria, with a desire for spectacle independence. Being a myope, she had been wearing contact lenses for years, but had switched to bifocal glasses 7 months earlier due to contact lens intolerance. Now, she was complaining about visual distortion and needing to use different glasses for distance, intermediate, and near vision, which was especially problematic at her job where she worked mostly at a computer. Wearing glasses was also not compatible with her hobbies that consisted mostly of water sports. The patient had researched treatment options and stated that she was particularly interested in corneal laser correction of her ametropia.

She underwent a standardized preoperative assessment protocol that included objective, subjective and cycloplegic refraction. She had no astigmatism. Manifest refractive spherical equivalent (MRSE) was -3.00 diopters (D) OD and -2.25 D OS.

Slit-lamp biomicroscopy and fundoscopy were performed as well as retinal (CIRRUS HD-OCT, Carl Zeiss Meditec AG, Jena, Germany) and corneal imaging (Pentacam, OCULUS Optikgeräte GmbH, Wetzlar, Germany) to rule out concomitant eye conditions (eg., maculopathies or diseases reducing corneal biomechanical stability). There were no remarkable findings in either eye, and the crystalline lens was clear OU. Although the patient reported using lubricant eye drops for occasional dry eye symptoms, the conjunctival and corneal surface examinations were also unremarkable.

Monocular distance corrected visual acuity (DCVA) measured at 4 meters was 20/16 (Snellen equivalent) OU, and reading vision measured at 40 cm was 20/50 (Jaeger 5) OU. Uncorrected visual acuity was 20/400 at distance and 20/20 (Jaeger 1+) at near.

The patient was thoroughly informed about the options available to treat her myopia and presbyopia. Because of the blurred vision she experienced with bifocal glasses and fear of developing halos and glare, she declined refractive lens exchange with implantation of multifocal intraocular lenses (IOLs). The possible risks of intraocular surgery and a wish to maintain her natural crystalline lens also contributed to her refusal of refractive lens exchange.

Corneal refractive surgery mini-monovision with small-incision lenticule extraction (SMILE) was offered as an alternative. The patient was thoroughly informed about the loss of distance vision in the near corrected eye, loss of near vision in the distance corrected eye, the possible loss of stereoacuity and binocular summation, and the possibility of requiring glasses for certain tasks, such as driving at night or reading small print. In addition, mini-monovision was simulated by fully correcting both eyes for optimal distance vision and then gradually pushing her non-dominant right eye towards myopia in steps of 0.25 D. The patient tolerated up to -1.25 D myopia in the non-dominant eye without suffering from binocular disturbance because of cross-blur.

SMILE was performed as a standard procedure using a 500 kHz femtosecond laser (VisuMax, Carl Zeiss Meditec AG, Jena, Germany). Target refractions were plano OD and -1.25 D OS. Minimum lenticule thickness was increased from 10 to 30 µm considering the low dioptric correction needed and our group’s report that increasing minimum lenticule thickness is associated with improved safety, predictability and induction of higher-order aberrations.1 The surgery was completed successfully without any intraoperative complications.

At 1 week, MRSE was -1.38 D OD and +0.25 D OS with -0.25 D of cylinder OU. Uncorrected distance visual acuity was 20/63 OD and 20/16 OS. Minimum lenticule thickness was increased from 10 to 30 µm considering the low dioptric correction needed and our group’s report that increasing minimum lenticule thickness is associated with improved safety, predictability and induction of higher-order aberrations.1 The surgery was completed successfully without any intraoperative complications.

Figure 1 compares the patient’s preoperative and postoperative vision. Note the improvement postoperatively in UDVA and CDVA along with her better uncorrected near VA postoperatively compared with her preoperative distance-corrected near VA. Consistent with the low anisometropia that was present preoperatively, the patient reported only mild bilateral blur.

At 1 month, the patient stated that the blur had progressively diminished. Full neuroadaptation had occurred, and the patient said she was very satisfied with her outcome. She was last seen 12 months after SMILE, and during the available follow-up, MRSE and visual acuity remained...
stable. The patient reported that except for using reading glasses when reading for a prolonged period of time, she had no need for glasses.

**DISCUSSION**

Many patients presenting with an interest in corneal refractive surgery to achieve spectacle independence are young and pre-presbyopic. In our clinic, however, up to 20 % of patients undergoing SMILE and other corneal refractive procedures are 45 years of age and older.

Whereas presbyopia correction is often presented to patients needing cataract surgery, this opportunity is less often discussed during preoperative counseling for corneal refractive surgery. Yet, the development of presbyopia accompanied by a need for reading glasses causes a reduction in quality of life. Therefore, preoperative education for patients with latent or manifest presbyopia who are interested in corneal refractive surgery should include the possibility of simultaneous treatment for ametropia and presbyopia.

Monovision excimer laser refractive surgery has a long history of use and has been shown to provide satisfactory results with high levels of spectacle independence. Compared to refractive lens exchange with implantation of a presbyopia-correcting IOL, laser corneal refractive surgery may be particularly attractive to patients with a clear crystalline lens because it avoids vision-threatening risks inherent to the intraocular procedure, which include endophthalmitis, retinal detachment, and cystoid macular oedema. Corneal refractive surgery also largely preserves ocular anatomy and offers the potential for enhancement.

SMILE is a newer laser corneal refractive surgery approach for the safe and effective treatment of myopia and myopic astigmatism. As a flapless procedure, SMILE has advantages compared with LASIK, including better preservation of corneal biomechanics, lower risk of dry eye, and less discomfort postoperatively.

This case highlights a role for SMILE to provide monovision and spectacle independence for presbyopic patients with myopia or myopic astigmatism. The excellent outcomes achieved in the patient in this case are representative of those we recently reported in a retrospective review conducted by Dr. Luft from our group, analyzing outcomes in 49 presbyopic patients seeking surgical correction of myopia or myopic astigmatism. In our published series, binocular UDVA was 20/20 or better in 90% of patients and 20/25 or better in all patients; mean binocular uncorrected near visual acuity was Jaeger 1 (20/25 Snellen equivalent). Eighty-four percent of patients achieved complete spectacle independence and 92% reported no need for reading glasses. Our experience is also consistent with that of investigators from the Nethradhama Eye Hospital, Bangalore, India, who reported satisfactory visual outcomes for near, intermediate, and distance vision accompanied by high levels of spectacle independence and patient satisfaction in a series of 18 myopic presbyopic patients treated with SMILE monovision.

**CONCLUSION**

SMILE monovision is a safe and effective treatment for presbyopic patients with myopia or myopic astigmatism who are interested in gaining spectacle independence. For surgeons who are experienced with SMILE, its application for monovision requires no additional skills nor any deviation from the standard technique apart from introducing mini-monovision into target refraction planning.

Whether achieved using pseudophakic monofocal IOLs or laser corneal surgery, however, monovision has visual consequences that can limit patient acceptance and satisfaction. To increase the likelihood of success, refractive surgeons should establish proper patient expectations by providing thorough preoperative counselling and perform an in-office simulation of monovision to assess tolerance. Correct identification of the dominant eye and limiting anisometropia to 1.5 D to maintain better stereopsis are also pivotal factors for patient satisfaction. In addition, we recommend aiming for plano as the refractive target in the dominant eye because unsatisfactory distance vision due to undercorrection in the dominant eye is the most common reason for retreatment in monovision.

Dr. Siedlecki, Resident in Ophthalmology, Ludwig-Maximilians-University of Munich, Munich, Germany. He is not a paid consultant for Carl Zeiss Meditec AG.

References
Making the distinction between two types of lamellar macular holes

Continuous of the external limiting membrane (ELM)/ellipsoid layers can help to identify eyes with lamellar macular holes that are likely to benefit from surgery, according to Dr John T. Thompson, of Retina Specialists, Baltimore, United States.

Dr Thompson addressed two types of partial-thickness macular holes – lamellar macular holes and pseudomacular holes (also called pseudoholes).

It can be hard to tell them apart, he pointed out.

“You can have two patients with similar central macular thickness,” Dr Thompson said. “One may fit the definition of a lamellar macular hole and the other a pseudomacular hole.”

Dr Thompson defined pseudomacular holes as a clinical diagnosis as seen via slit lamp biomicroscopy versus optical coherence tomography (OCT).

“Use pseudomacular holes only to describe the biomicroscopic appearance,” he added.

In contrast, a lamellar macular hole is defined by the appearance of the fovea via OCT.

“I’d propose that there is often a steep irregular contour,” Dr Thompson outlined. “It may have interretinal splitting. Epiretinal membranes are virtually always present, and some eyes have lamellar hole-associated epiretinal proliferation. The natural history of lamellar macular holes is reasonably good, and they do not tend to progress.”

Dr Thompson also described a subgroup of patients who have secondary lamellar macular holes, who often have chronic diabetic macular oedema or cystoid macular oedema and they do not tend to benefit from vitrectomy.

Although studies of surgical results for the treatment of lamellar macular holes have been positive, the studies tend to be small and are not randomised, Dr Thompson said.

Dr Thompson has a study pending publication that includes 64 eyes with lamellar macular holes in patients with decreasing visual acuity. The study will share the results from patients at both 3 months and 1 year.

Dr Thompson detailed additional differences between lamellar macular holes and macular pseudoholes.

“Spectral-domain OCT is required to diagnose lamellar macular holes,” Dr Thompson said. “They are characterised as having an abnormally steep foveal contour.

“Almost all are associated with epiretinal membrane (ERM),” he added. “The central fovea may be thick, normal or thin. Macular pseudoholes are a biomicroscopy diagnosis, and there may or may not be a lamellar hole.”

Most lamellar holes do not require treatment.

“Visual acuity, especially if it’s decreasing, should be the primary determinant of whether or not to offer surgery,” Dr Thompson said.

Eyes with prominent ERM may require surgery because they tend to have less favourable results if they are not treated.

**IN SHORT**

- Lamellar holes usually do not require treatment, but it is important to recognise those eyes that may benefit from vitrectomy.

By Vanessa Caceres;
Reviewed by
Dr John T. Thompson

Dr John T. Thompson, MD
j.thompson@retinaspec.com

This article was adapted from Dr Thompson’s presentation during Retina Subspecialty Day at the 2017 meeting of the American Academy of Ophthalmology. Dr Thompson has no disclosures relevant to his talk.
Glaucoma is a degenerative disease characterised by typical morphological changes in the optic nerve head (ONH) and the retinal nerve fibre layer (RNFL), followed by a corresponding loss of the visual field (VF), having a major impact on the quality of life of patients. The complex nature of glaucoma requires a comprehensive assessment of each patient, including measurement of IOP, and ONH and VF evaluation, which are critical steps in the diagnosis and monitoring of the disease.

**Optic nerve head assessment**

The detection of structural damage to the ONH is central to the diagnosis of glaucoma and is extremely important for monitoring both patients at risk and those with established disease. Glaucoma, by definition, is an optic neuropathy and, therefore, particular attention must be given to examination of the optic nerve.

The ONH is the site at which the dropout of retinal ganglion cells is identified most easily using current clinical techniques and is postulated as the primary site for damage. Traditionally, the assessment of ONH health is performed by stereoscopic photographs; a technique that improves the detection of RNFL and optic disc changes, including optic disc haemorrhages (ODHs) that would not be evident on ophthalmoscopy or monoscopic photographs. The Ocular Hypertension Treatment Study compared stereoscopic photographs with clinical examination in 1,618 participants (3,236 eyes) who were followed for 96.3 months. The photographs enabled the detection of ODHs in 128 eyes of 123 participants. Twenty one cases (16%) were detected by both clinical examination and review of photographs, and 107 cases (84%) were detected only by review of photographs \( (P<0.0001) \).

Regarding the monoscopic photograph of the retina, the lack of stereopsis could lead the operator to assess the clinical situation on the basis of the colour of the area rather than the contour of the neuroretinal rim; but the stereoscopic photography provided higher levels of interobserver agreement compared with monoscopic assessments. Observers reading photographs in the context of major clinical trials are generally reported to have low interobserver variability, while others have reported much greater variability.

Despite its advantages, traditional stereoscopic photography has some limitations. Firstly, the process of capturing the image is not easy, since the cameras are complex and the process is time-consuming. In addition, the reliability of the image is highly influenced by such factors as the camera angle, photographic technique, lighting and magnification; while the experience of the operator evaluating the photographs also has an effect.

The above-mentioned constraints of stereoscopic photography have favoured the diffusion of high-tech imaging technologies, such as optical coherence tomography (OCT), which allows fast and reproducible high-resolution quantitative evaluation of ONH and RNFL with good diagnostic accuracy. Imaging with OCT, however, also has some inherent drawbacks, such as the lack of qualitative

**IN SHORT**

Stereoscopic photographs are a useful tool in the detection of glaucoma, however, the difficulty in obtaining them has seen them underused in favour of optical coherence tomography (OCT). A new device is attempting to redress this balance, enabling stereo-photography to be used alongside OCT for optimal practice.
Increasing the scope

The stereoscopic photograph—for its reliability, the qualitative nature of the image, and possibility of monitoring patients over the long term—provides relevant information for the assessment of the ONH that warrants being integrated with the data obtained with OCT. However, its aforementioned technical limitations have caused a decline of stereoscopic photography, thus reducing the availability of valuable data for the diagnosis and monitoring of glaucoma.

A new automated perimeter combined with a white light scanning ophthalmoscope, Compass (Centervue), provides confocal images of the retina. The stereo photograph feature of the device overcomes some of the limitations of traditional stereo photographs, due to the specific techniques used. The most significant advancement is represented by its process of image acquisition: the first photograph is automatically captured with a focus on the rim; while for the second photograph, the device automatically focuses on the lamina cribrosa. This double focus enhances its three-dimensional effect and, together with the confocal system and the white light source, enables the capture of high-quality images.

In our experience, we obtained excellent images without the need for pupil dilation – the assessment of ONH was possible even in the presence of media opacities, such as early and mild cataract. The characteristics of the device define a new role for stereoscopic photography as a method to be used alongside OCT, to improve the capabilities of diagnosis and monitoring the course of glaucoma.
REFERENCES


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Dr Oddone performs clinical, surgical and scientific activities at the IRCCS G.B. Bietti Foundation Britannic Hospital in Rome, Italy. Since 2015, he has been head of the Glaucoma Unit. Dr Oddone is a consultant for Centervue, Allergan and Glaucon, and a speaker for Santen, Haag Streit, Glaucom and Dmekron Italia.

HIGHLIGHTS IN 2018:
- Discover recent advances in the treatment of glaucoma
- Gain insight into the first FDA-approved gene therapy, developed for the treatment of inherited retinal dystrophy
- Discuss case studies on novel non-invasive and site-specific drug delivery strategies
- Examine the applications of artificial intelligence in drug discovery
- Explore the use of biomarkers and surrogate end-points from a regulatory perspective
Deciphering cellular and tissue responses in glaucoma are key to preventing and curing the disease. Some recent insights into the behaviour of cells subjected to mechanical insult due to increased IOP and changes in the stiffness of the sclera are helping to unravel the secrets of glaucoma, according to Dr C. Ross Ethier.

One important observation is that the cells in the optic nerve head (ONH) are sensitive to mechanical changes. “In general, cells are mechanosensitive and will, for example, migrate to a preferred substrate stiffness,” said Dr Ethier, the Lawrence L. Gellerstedt Jr., Chair in Bioengineering, Georgia Research Alliance Eminent Scholar in Biomechanics and Mechanobiology, and professor of biomedical engineering, Georgia Institute of Technology/Emory University, Atlanta, United States.

Dr Ethier provided an example of this preferential activity. When a cell is released from the soft side of a gel, the cell migrates to the stiff side of the gel. In the opposite scenario, when the cell is released on the stiff side of the gel, the cell does not move to the soft side. “This behaviour tells you that cells have the ability to sense the mechanical properties of their substrate and respond to them,” Dr Ethier said. “We now know that substrate stiffness influences cellular growth, motility, apoptosis, and even differentiation of stem cells.”

All of these activities have shown investigators that nearly all cell types contain sophisticated machinery for sensing and responding to mechanical stimuli, he explained.

One such cellular system is the YAP-TAZ pathway, which, in addition to responding to substrate stiffness, also responds to the softness and stiffness of three-dimensional (3-D) matrices and stretching resulting from pressure, which is relevant to the ONH.

More about the ONH
This structure is a major player in glaucoma, and the importance of determining why it is vulnerable to pressure, among other forces, cannot be overemphasised. Computational modelling of the ONH predicts high mechanical strains in the ONH tissues, indicating that the ONH is a weak spot in the otherwise tough corneoscleral shell, Dr Ethier noted.

Nearly all cell types contain sophisticated machinery for sending and responding to mechanical stimuli.

Experimentally, micro-computed tomography 3-D imaging of the ONH region of an enucleated porcine eye showed the strains that occurred when the eye was subjected to different IOP levels. For example, the anterior and posterior lamina cribrosa within the ONH undergo significant stretching and compression as IOP increases, corresponding to deformations thought to exceed safe ranges that the cells can tolerate.

Cerebrospinal fluid pressure also can affect strains in the ONH. “We know that when looking at the average or peak strains in the lamina cribrosa or in the retrolaminar neural tissue just posterior to the lamina, the strains are well outside of the safe ranges, especially in the retrolaminar neural tissue,” Dr Ethier said.

Another consequential factor
Another potentially important factor is optic...
nerve tension. Investigators who recently used a numerical model to look at the effect of tension in the optic nerve sheath on the ONH found, surprisingly, that traction forces in the optic nerve sheath were great and created stress in the peripapillary tissue nasally and temporally (Wang et al. Invest Ophthalmol Vis Sci 2016;57:2452-2462. doi: 10.1167/ iovs.15-18986).

When those investigators then looked at the effects in a small clinical cohort using optical coherence tomography, they also, surprisingly, found large strains in the lamina cribrosa. With ocular movements, specifically adduction, strains in the lamina cribrosa were found to be “quite significant,” according to Dr Ethier.

**Practical considerations**

When this information is considered clinically, Dr Ethier said the sclera is an important factor.

“The sclera matters a lot: mechanical strains in the ONH are thought to be much higher in eyes with a soft sclera, thus leading to the possibility of altering the course of glaucoma by intervening to stiffen the sclera,” he said.

In an experimental rat study, the sclera was stiffened, ocular hypertension induced, and the optic nerves followed. Importantly, the preliminary results showed the stiffening protected against axonal loss.

“This is extremely interesting and provocative,” he said.

However, in another study performed in mice, the opposite was found.

“The scientific questions remain very much open and there is still a lot to be discovered,” Dr Ethier said.

Lastly, Dr Ethier commented on an in vivo study that estimated the biomechanics of the ONH by segmenting the tissues and computing the deformations of the ONH in control subjects and in patients who had undergone filtering surgery. The investigators found large reductions in strains in certain patients.

‘In general, cells are mechanosensitive and will, for example, migrate to a preferred substrate stiffness.’

— Dr Ethier

“The ability to interrogate the ONH and the mechanical strains in this tissue is slowly being translated to a clinical environment,” Dr Ethier said.

“This will help us understand what is happening biomechanically in glaucoma in the ONH.”

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This article was adapted from Dr Ethier’s presentation during Glaucoma Subspecialty Day at the 2017 meeting of the American Academy of Ophthalmology. Dr Ethier has no financial interest in any aspect of this report.
Rediscovering the goniotomy option

Use with dual blade may lower IOP and reduce the need for medication

By Dr Rajen U. Desai

Relocating from one state to another recently led to an interesting surgical transition.

As background, from 2014 to 2017, I was employed by an insurance company in New York City, United States, as its only full-time, in-network glaucoma surgeon in Brooklyn. Surgical volumes were high, with many trabeculectomies and tube shunts each month. However, last year with the birth of my first daughter, my wife and I decided to make the proverbial move to the suburbs and I began practicing at The Witlin Center for Advanced Eyecare, a referral-only surgical practice in New Jersey.

Though it was sad to leave my friends and colleagues, it was also bittersweet to be parting ways with some of the patients that I had come to know over the years.

Transition plan

Dozens of patients were planned for surgery in the months before my departure, which presented itself as a challenge. Could I perform a trabeculectomy and leave the follow-up and need for potential repeat surgeries to colleagues who may not have the same protocols or surgical approach that I did?

If a trabeculectomy post-operatively required a needleling, choroidal drainage, compression sutures or bleb leak repair, there was no one else in my office comfortable performing these procedures, and the trab would likely fail. The only other glaucoma surgeons were either out of the patients’ insurance network or located too far away for my patients to adhere with appointments.

There was another subset of patients in their early 60s with severe glaucoma damage who needed filtration surgery in one eye, but because their fellow eye lost vision after a trabeculectomy or tube shunt years ago, they refused the option of “cutting open the eye again.”

It was disheartening monitoring these patients with IOPs in the high 20s or mid 30s, watching the arcuate scotomas envelope fixation like a whirlpool flushing their island of vision down the toilet. Every visit for 3 years would be the same: pleading with them to undergo a trabeculectomy, their adamant refusal, and their leaving my office on the same three drops they had been on for years.

With that in mind, I was looking for a standalone surgical alternative to performing trabeculectomies that was safe, effective and straightforward for patients in need of IOP control. This is when I recalled a recent conversation with a colleague about a new tool used to perform goniotomy (Kahook Dual Blade, New World Medical).

I had always thought of goniotomy as a procedure for paediatric glaucoma that did not have long-term effects. Although I was familiar with other MIGS procedures, I had not heard as much about this dual blade so I was skeptical, but curious.

Still, as an early adopter, I thought trying a few could not hurt. If my patients needed more control after goniotomy with the dual blade, they would at least have trabeculectomy or other MIGS procedures as options since the conjunctiva would be intact.

The single-use blade makes parallel incisions in the trabecular meshwork and inner wall of Schlemm’s canal to excise diseased tissue and allow increased aqueous outflow. The device’s microengineered profile allows it to be inserted ab interno through a clear corneal incision, representing a minimally invasive surgical option. The blade’s pointed tip pierces the trabecular meshwork under gonioscopic view, a ramp lifts and stretches the tissue, and two...
blades produce incisions that excise the trabecular meshwork. Nevertheless, referring surgeons and patients alike have the expectation that a procedure will be effective with the fewest number of postoperative medications (and side effects) and repeat trips to the operating room. I am not often eager to leave a bleb in the hands of a co-managing physician. This is when I started thinking that goniotomy could be a viable, straightforward, and effective procedure that would preserve future options but also allow for less follow-up and postoperative care than traditional options.

I initially began using the blade to perform goniotomy in phakic patients. Based on my IOP-lowering results with goniotomy as a standalone procedure, I have become enthusiastic about the role of goniotomy in the overall glaucoma treatment strategy combined with cataract surgery and in pseudophakic patients as well. With experience in more than 50 patients, I have seen anywhere from 10- to 20-point reductions in mm Hg performing goniotomy-alone.

I started performing goniotomy with the blade almost a year ago. Results at 1 year are impressive and fairly consistent with what I saw just after the procedure. Seeing my outcomes firsthand, my partners have asked me to perform goniotomies using the dual blade on their own family and friends, when other specialists only offered the patients a trabeculectomy.

To my surprise, I seldom have had to perform trabs anymore on patients with IOPs >30 mm Hg, but I keep that option open if MIGS, tubes and cataract surgery cannot do the job, or if the preoperative IOP is already in the teens. Goniotomy with the dual blade has become my initial go-to procedure for patients needing better IOP control or who are not compliant with medications.

**My approach**

I determine pre-operatively how many clock hours of trabecular meshwork tissue to remove, based on the patient’s target and pre-operative IOP.

Using gonioscopy, I look for areas of increased levels of pigmentation in the trabecular meshwork that reveal the collector channels. I will aim my incision with the dual blade in this area to have the biggest effect, giving aqueous direct access to the collector channel. In pseudophakic patients, Trypan blue is helpful to illuminate the area and create landmarks for the surgery, especially in patients whose trabecular meshwork is lightly pigmented.

I make a sub-1.5-mm incision, just enough for the dual blade to slide through. Goniotomy is performed under ophthalmic viscoelastic device (DuoVisc, Alcon Laboratories) and I have seen no striae, very little hyphaema and few pressure spikes. I fill the anterior chamber with cohesive OVD ProVisc (Alcon), excise the trabecular meshwork with the blade, then irrigate away the ProVisc and simultaneously check for blanching of the perilimbal episcleral venous wave (as described by Dr Ronald Fellman and Dr Davinder Grover), and then coat the nasal third of the anterior chamber angle with dispersive OVD Viscoat (Alcon).

Properly maintaining the anterior chamber and good visualisation of the target tissues are key.

Through refining the technique, I have found that removing a
few clock hours of trabecular meshwork via goniotomy, if performed in the correct spot, can correlate with a 10-point reduction in mm Hg.

Ironically, by looking for an option that would allow for the smooth departure from clinic in New York, I rediscovered just how effective and safe could be performing a goniotomy.

A word about gonioscopy

Becoming familiar with gonioscopy and angle-based surgery and getting comfortable with tilting the patient’s head can be high hurdles for some surgeons to overcome. Where the patient’s head is positioned and the surgeon’s ability to see the angle clearly are vital in this procedure.

Newer surgical goniolenses have been designed specifically for minimally invasive procedures. These essentially clip onto the eye, so the surgeon does not have to move the patient’s head or the microscope. A tool like this can help one get started with angle-based procedures.

As with adding any new technique to one’s surgical repertoire, gonioscopy is a learned skill requiring practice.

In the past, goniotomy and trabecular bypass methods have been seen as safe, although not particularly effective strategies for lowering IOP, and most surgeons think of it as a procedure for pediatric glaucoma.

Due to these preconceived ideas, it has often not been considered as an effective option for IOP lowering in adults.

For today’s glaucoma surgeons, however, the ability to perform angle-based surgery is akin to cataract surgeons’ implanting premium lenses or correcting astigmatism.

Angle-based surgery is a paradigm shift and is poised to play a larger role in glaucoma management. Less tissue is destroyed, allowing for future procedures if needed.

Keeping an open mind about incorporating goniotomy into my practice allowed me to discover a procedure that I had not considered before. New tools, such as the Kahook Dual Blade, have made this procedure a versatile, viable and effective solution in my practice.

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**Seven Tips for Successful Goniotomy with a Dual Blade**

1. **Place the patient in the reverse Trendelenburg position, about 20° is often ample. If you can visualise a stripe of blood in Schlemm’s canal, try increasing the angle to 30°. Remember, the less blood collecting in the canal, the less the intraoperative blood reflux, and the less hypHEMA the next day.**

2. **For operating on the patients’ right eye, perforate the trabecular meshwork strip in a clockwise direction around 1- to 2-o’clock, then rotate the blade and excise the trabecular meshwork strip in a counter-clockwise direction from 4- to 5-o’clock, excise a small sub-1-o’clock hour trabecular meshwork strip clockwise. While it is easier to excise the trabecular meshwork strip in its entirety this way, if a tag remains, try using MST scissors and forceps to amputate it.**

3. **You can also simply leave the trabecular meshwork strip in place, as long as it is at least 2 clock hours in length and curled up on the edge. Otherwise, it can sometimes unfurl itself and obstruct Schlemm’s canal.**

4. **After irrigating the cohesive OVD with BSS, consider burping the paracentesis to see the favourable sign of blood reflux. This helps demonstrates that there is connectivity between the anterior chamber and Schlemm’s canal. Immediately inject dispersive OVD deep into the nasal third of the anterior chamber to tamponade the heme. If you do not see the blood reflux, tilt the patient back in a flat position (i.e., not in reverse Trendelenburg) to see if blood reflux return. If it still does not appear, consider extending the goniotomy.**

5. **Immediately after tamponading the heme, hydrate the incision and bring the patient upright as soon as possible. Especially if patients could not stop their anticoagulants, this will help reduce hyphema. You can always remove the drapes while they are upright.**

6. **Instruct the patient to sleep upright at an angle overnight—the same instruction which you would give any hyphema patient. I have not seen any layered hyphemas using this technique.**

7. **If the IOP is significantly reduced by post-day 1, but then rises dramatically after the first week, consider an early steroid response. In these cases, I change the steroid to an NSAID (and restart a glaucoma drop), and have seen the IOPs reduce by the following week.**

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**Dr Rajen U. Desai**
See the **sharpest** image of retina health.

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Having optical coherence tomography (OCT) in the operating room can save time and money, reduce revisions and improve patient outcomes.

“Just like in the office setting, intraoperative OCT can allow you to see structures you can’t normally see with the typical light microscope,” said Dr Francis W. Price Jr., founder of Price Vision Group, Indianapolis, United States and founder/president of the Cornea Research Foundation of America. “That’s why it shines with endothelial keratoplasty and anterior lamellar surgery.”

Manufacturers may have expected intraoperative OCT to find its widest application in retina procedures, but Dr Price said it can be invaluable in the cornea and anterior chamber procedures which fill most of his operating schedule.

Intraoperative OCT can also be helpful in some cataract surgeries, he noted. Lamellar transplants can benefit greatly from the improved imaging provided by intraoperative OCT. OCT can reduce surgical time for endothelial keratoplasty, particularly Descemet’s stripping endothelial keratoplasty (DSEK) and Descemet’s membrane endothelial keratoplasty (DMEK).

“Intraoperative OCT can be helpful in DSEK by making sure that the graft is in total apposition with the recipient cornea,” Dr Price explained. “OCT helps you ensure there are no spaces, no abnormalities like Descemet’s membrane that is curled up or stroma that is keeping the graft from adhering. And you get visual reassurance that your graft is positioned properly and tightly in place.”

In DMEK, Intraoperative OCT quickly identifies the orientation of the graft, even in cloudy corneas, Dr Price said. Fast and positive graft orientation speeds the case as it enhances safety and improves outcomes.

“The third type of transplant where intraoperative OCT is extremely helpful is deep anterior lamellar keratoplasty,” Dr Price said. “The gold standard for these procedures is to do a big bubble. But there are cases where you can’t use a big bubble to separate Descemet’s membrane from the rest of the cornea. And sometimes you just can’t get that big bubble to form properly.”

Eyes that have scars from previous cataract surgery are not good candidates for big bubble formation. Eyes with hydrops, commonly seen with keratoconus, do not do well with big bubbles. Nor do eyes that have had previous radial keratotomy or other procedures that form scars including Descemet’s membrane.

Manual dissection has always been a potential strategy in these eyes, but effective manual dissection is difficult using conventional microscope imaging. The dissection bed must be less than 100 μm deep for excellent visual results following deep anterior lamellar grafts. Dissection must be uniform, he added.

“If you have variable thickness, your visual outcome will be poor,” Dr Price cautioned. “By using intraoperative OCT, you can have excellent results with your manual dissection without using a big bubble. That’s particularly important in those eyes where you can’t get one.”

Use in cataract surgery
Most ophthalmologic surgeons work on cataracts, Dr Price noted. Cataract surgeons, too, can work more effectively using intraoperative OCT.

OCT does not go through the iris, he said.
but it gives a clear view into the anterior chamber. That gives OCT an advantage in spotting nuclear fragments from very dense cataracts that have lodged in the angle and are less visible through conventional imaging.

Dr Price added that OCT is especially useful when the surgeon has used dispersive viscoelastics. Viscoelastic can be difficult to clear from the angle, even more so when there are dense nuclear fragments present.

**Time saver**

Improved imaging can save time in many different transplant procedures, Dr Price said. He sees the greatest time savings in endothelial keratoplasty. Many surgeons stamp grafts with an “S” to help with final positioning. But the stamp can be difficult to see before the graft is unscrolled, particularly through a cloudy cornea. Intraoperative OCT clearly images the graft orientation and speeds the procedure.

Deep anterior lamellar transplants may not move more quickly using intraoperative OCT, but using it does not slow the surgeon down, Dr Price said. The improved imaging enhances outcomes and sharply reduces the need to return to the eye with penetrating keratoplasty. Reducing the need for PK revisions gives intraoperative OCT an advantage over conventional imaging.

One advantage of current intraoperative OCT application is the ability to display the image in the ocular. Another useful piece of implementation is the ability to view OCT images as picture in picture with microscope view.

DR FRANCIS W. PRICE JR., MD
E: mprice@cornea.org

This article was adapted from Dr Price’s presentation during Cornea Day at the 2017 meeting of the American Academy of Ophthalmology. He did not indicate a proprietary interest relevant to the subject matter.

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**What’s Trending**

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(Video courtesy of Dr Mark A. Terry)

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In 2017, 120 ophthalmologists and other eye care professionals voluntarily visited Cambodia at close-to-weekly intervals in an initiative that was facilitated by the Khmer Sight Foundation. Most were from the United Kingdom but there were also volunteers from Germany, Austria, Italy, Singapore and India.

The goal was to screen 20,000 Cambodians in need of eye care and perform up to 10,000 cataract and pterygium surgeries. This year, the need is still pressing, and the Khmer Sight Foundation continues to welcome new volunteers.

**Ophthalmologists shortage**

Where ophthalmology is concerned, there is a significant unmet need in Cambodia. In a country that was ravaged by a tragic past during the Khmer Rogue era and only now slowly recovering, there are only 38 ophthalmologists available to serve a nation of 15 million.

Close to 28,000 Cambodians go blind every year and, sadly, 90% of blindness is avoidable. The scale of the issue is possibly underestimated due to incomplete epidemiological data but the logic is irrefutable; socioeconomic deprivation and having a disability creates a vicious cycle of poverty.

As clinicians in Europe, we often take for granted what goes on behind the running of a successful eye service. We walk into our clean workspace in the morning, prepared by the invisible cleaning fairy, and sit in our well-equipped office, where the magical equipment elf has been stocking the cupboards overnight with lenses, devices and all sorts of drugs.

In your usual theatre, The Magical Force delivers what you need – biometries, IOLs, microscopes, clean instruments, and a working phacoemulsification machine. You do not challenge The Magical Force.

**Overseas challenges**

The truth is, a lot goes into providing a high-quality and high-volume service. To start it from almost scratch with limited resources, for a population that may not have had eye health as their priority, is truly not a walk in the proverbial park. It is more like a marathon. Whilst wearing flip-flops.

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**IN SHORT**

Ophthalmologists around the world have been dedicating their time and expertise to deliver eye care services, including screening and surgery, in Cambodia, in an initiative supported by the Khmer Sight Foundation.
We need to deliver good-quality care – but within practical means. Everything has a cost to it, either in terms of time, man-power or equipment. Ophthalmology is an equipment-heavy specialty and our clinics and theatres use up a lot of consumables. Stock is expensive and donated from various charitable sources, so the supply is limited. Working in Cambodia makes one realise how much we truly waste when we are back home!

Another challenge is that often, despite the best intentions of the treating doctor and the translator, it can still be difficult to obtain the patient’s full history. This could be due to the patient’s understanding of their condition,
their knowledge, the chronicity of their untreated disease, or a combination of these factors.

General medical practice can be quite paternalistic, and patients often prefer it that way (“just make the decision for me, doctor”). I observed, however, that we western-trained doctors naturally try to reach for patient-centred decisions (“what would you like to have done?”). This does not work all the time; in Cambodia, we became adept at making quick decisions in patients’ best interests.

Theatre is another challenge, owing to sterilisation techniques, the sharing of equipment (for example, one phaco cassette for four to five patients), a mixed variety of IOLs, the lack of specialist equipment (limited anterior vitrectomy kits), inexperienced staff, and most importantly, dense and difficult cataracts.

**A baby delivered**

Funnily enough, despite being on the other side of the world, one patient group remains consistent. At least in Cambodia, they seem to be actually slightly pleased after...
you prescribe some eye drops. Postoperative corneal oedema was a real issue, but fortunately it does settle with time.

A visually significant right pterygium

The main challenges that Cambodia face are lack of expertise (they have one of the lowest number of ophthalmologists per capita in the world) and lack of access (many destitute patients live in rural areas with poor access to healthcare).

For a Cambodian villager to go from screening to clinic to eye doctor to surgery is a real mammoth task in terms of organisation and logistics. Fortunately, every villager owns a mobile phone or at least knows someone who does.

Just some example of patients that we could not help but would plan to:

Top left: Orbital tumour and proptosis. These patients often present late when the symptoms become severe.

Top middle: Children with blinding conditions like glaucoma or anterior segment anomalies. There are plans to bring in anaesthetic support and offer treatment that can be curative for paediatric conditions. Top right: End-stage glaucoma is common and sometimes can only be seen after a dense cataract is removed. Glaucoma will be difficult to tackle due to access to follow-up.

Bottom left: Patient with bilateral hand movement vision is noted to have severe pigmentary retinopathy. Support services are virtually non-existent in Cambodia so the only thing we could do in these cases was give them a diagnosis. (Images courtesy of Dr Damien Yeo and Prof. Sunil Shah)

I am sure I echo the sentiments of all the volunteers who visited when I say that it was a refreshing and humbling experience – and we would like to take this opportunity to thank KSF, Sean Ngu and the people of Cambodia for welcoming us.

Cambodia is re-building itself. The deep scars of her past will always be palpable but the resilience of her youthful generation stands out. The new generation of Cambodians will be her greatest resource, and education, training and self-sufficiency the most worthwhile investments.

Working in Cambodia makes one realise how much we truly waste when we are back home!

Bottom left: Patient with bilateral hand movement vision is noted to have severe pigmentary retinopathy. Support services are virtually non-existent in Cambodia so the only thing we could do in these cases is give them a diagnosis. (All images courtesy of Dr Damien Yeo and Prof. Sunil Shah)
Know the differential disorders between the brain and eye

Bridging the gaps between neuro-ophthalmic disorders crucial to vision

By Michael Apolinario; Aroucha Vickers, DO; Claudia M. Prospero Ponce, MD; Andrew G. Lee, MD

Neurologists may be first-line clinicians for patients who present with specific neuro-ophthalmologic conditions. Although these conditions may require co-management with an ophthalmologist or neuro-ophthalmologist, the neurologist should be able to triage and recognise the key and differentiating features of these common neuro-ophthalmic conditions:

- papilledema and idiopathic intracranial hypertension (IIH)
- anterior ischaemic optic neuropathy (AION)
- optic neuritis
- ocular motor cranial neuropathy
- Horner syndrome.

Early diagnosis and treatment of these conditions may be potentially life or vision saving.

Idiopathic intracranial hypertension

Idiopathic intracranial hypertension (IIH), also known as primary pseudotumour cerebri, refers to symptoms and signs of increased intracranial pressure (ICP) in the absence of a true tumour (space-occupying lesion) or other potential causes, such as venous sinus thrombosis, meningeal lesions, hydrocephalus/aqueductal stenosis and others. Most commonly affecting younger, obese women, IIH is not completely benign and approximately 1% to 2% of patients suffer vision loss. The pathogenesis of IIH is unknown, although altered cerebrospinal fluid (CSF) production or absorption, abnormal vitamin A metabolism, endocrine dysfunction and sleep apnea are proposed mechanisms.

Presentation and symptoms

Most patients with IIH initially present with a headache that may mimic migraine. The headache may be unilateral, bilateral or diffuse; throbbing or non-throbbing in quality; and may be associated with nausea, vomiting and photophobia.

Differentiating features that separate IIH from migraine include pulsatile tinnitus, which is more specific for IIH, transient visual obscurations (lasting seconds at a time) rather than the typical fortification, scintillation scotoma of migraine, and diplopia due to sixth nerve palsies (a non-localising sign of increased intracranial ICP).

The key and differentiating sign of IIH is papilloedema (Figure 1)—although it is not required to make the diagnosis. Visual acuity is generally unaffected until late in the course of IIH but fulminant IIH may produce acute loss of central vision and should be treated more aggressively and urgently. Fulminant IIH may require surgical intervention.

IN SHORT

Neurologists are often the first ones who notice and then diagnose potentially dangerous neuro-ophthalmologic conditions. Triage and an early diagnosis can save not just vision, but lives.
IIH is a diagnosis of exclusion and therefore, other causes of increased ICP should be excluded, including a mass lesion, venous sinus thrombosis or malignant hypertension. The diagnosis of IIH is made based on the modified Dandy criteria.

Treatment of IIH is multidisciplinary and involves weight reduction, plus medical management including first-line treatment with acetazolamide. Agents such as furosemide or topiramate have also been used with anecdotal success, but acetazolamide has been shown in a recent clinical trial to be an effective first-line treatment.1,2

Surgical interventions, such as optic nerve sheath fenestration, venous sinus stenting, or lumboperitoneal or ventriculoperitoneal shunting, may be necessary if maximum medical management fails or in the setting of fulminant IIH.

**Anterior ischaemic optic neuropathy**

Anterior ischaemic optic neuropathy (AION) is the most common cause of acute, unilateral optic neuropathy in adults.4 It is classified as arteritic (A-AION) or non-arteritic AION (NAION).

NAION is characterised by acute, typically unilateral and painless loss of vision, an ipsilateral relative afferent pupillary defect (RAPD), and a swollen (sector or diffuse) optic nerve. A small cup-to-disc ratio (known as the structural “disc at risk”) is believed to be a predisposing risk factor for NAION (Figure 2).

Other proposed risk factors include vasculopathic conditions (e.g., hypertension, hyperlipidaemia, diabetes and sleep apnea).

To date, there remains no proven effective treatment for NAION, but risk factors should be managed to reduce occurrence in the fellow eye or a second episode in the same eye. Corticosteroids have been used with some anecdotal success. An ongoing clinical trial is under way to test anti-apoptosis agents given intravitreally.

In contrast to NAION, A-AION is caused by giant cell arteritis. A-AION can occur unilaterally or bilaterally and may be severe with rapid blindness in both eyes if not recognised and treated early. A pale and swollen optic nerve (i.e., pallid disc oedema) is highly suggestive of giant cell arteritis (GCA) in A-AION but may be especially helpful in posterior ION where the disc is not swollen.
Optic neuritis

One of the most common neuro-ophthalmologic disorders that present to neurologists is optic neuritis (ON). Idiopathic or demyelinating inflammation of the optic nerve (Figure 4) is referred to as ON.

Patients with ON typically present with subacute unilateral vision loss, pain with eye movement, dyschromatopsia, relative afferent pupillary defect and usually a normal or sometimes mildly swollen optic nerve.

In the Western hemisphere, ON is most commonly associated with multiple sclerosis (MS) and can be the presenting finding in up to 25% of cases. In addition to MS, however, the differential diagnosis includes neuromyelitis optica (NMO) and neuromyelitis optica-spectrum disorders (NMOSD).

NMO is an autoimmune disease characterised by an antibody-mediated attack against aquaporin-4 receptors and is characterised by longitudinally extensive (< 3 vertebrae) spinal cord lesions (transverse myelitis) in addition to ON. Patients with ON should be asked about symptoms such as unexplained nausea or vomiting, intractable hiccups and excessive daytime somnolence, which would indicate involvement of aquaporin-4 rich areas.

Magnetic resonance imaging (MRI) of the brain may predict MS (periventricular white matter lesions); thus, patients with ON should undergo neuroimaging (typically MRI of the brain and orbits with and without gadolinium). Additional loss (amaurosis fugax) episodes that are not seen in NA-AION.

These red-flag symptoms should prompt additional testing for giant cell arteritis (e.g., erythrocyte sedimentation rate, C-reactive protein and platelet count). Prompt corticosteroid treatment should be considered to prevent further visual loss. A diagnostic temporal artery biopsy can be confirmatory of giant cell arteritis.

Patients with GCA often have other constitutional and systemic symptoms preceding the vision loss including jaw claudication, scalp tenderness, neck pain and headache located in the temple.

In addition, patients with GCA may experience transient visual

(Figure 3) Pallid optic nerve in arteritic anterior ischemic optic neuropathy (A-AION).

(Figure 4) A-B. MRI brain and orbit showing enhancement of the right optic nerve in a patient with optic neuritis.
imaging of the spine to evaluate for other lesions as well as evaluation for radiographic dissemination in time and space may be helpful. Patients with symptoms or signs of transverse myelitis should also be considered for spinal imaging.

Findings from the Optic Neuritis Treatment Trial (ONTT) indicate that treatment of ON with intravenous corticosteroids may hasten visual recovery but does not change the final visual outcome.7

Treatment and evaluation of the underlying condition (e.g., MS, neuromyelitis optica, sarcoidosis) should be considered, if present. In most cases, the visual loss in idiopathic- or multiple sclerosis-related ON is self-limited and spontaneously resolves in more than 90% of cases.8 Failure to recover is a red flag to consider an alternate diagnosis.

**Ocular motor cranial neuropathy**

Ocular motor cranial neuropathy often presents with diplopia and can present to a neurologist.

In a patient with binocular diplopia, determining the direction of the diplopia (horizontal, vertical, oblique), location of the lesion and its causes are important because treatment (e.g., observation, medical treatment, surgery) depends on etiology.

Three ocular motor cranial nerves control eye movements (the third, the fourth and the sixth nerves) and damage can occur to a single nerve or combinations of the nerves. Multiple cranial nerve involvement should raise suspicion for a cavernous sinus process (including meningioma, carotid artery aneurysm or inflammation), multiple lesion, or meningeal process.

Myasthenia gravis should also be considered in any pupil spared, painless, non-proptotic and ophthalmoplegic (including patterns resembling ocular motor cranial neuropathies).

**Differential diagnosis**

Isolated ocular motor cranial mononeuropathies are most commonly the result of microvascular ischaemia from
uncontrolled vasculopathic risk factors in older patients.

A third-nerve palsy may be complete or incomplete, and either pupil-sparing or involving. The “rule of the pupil” suggests that a third-nerve palsy plus pupil involvement (relatively larger and less reactive) is due to a compressive lesion (such as an aneurysm) until proven otherwise. Therefore, initial neuroimaging (CT, MRI) should include MR angiography (MRA) or CT angiography (CTA).

Partial palsy or partial pupil-involved cases also deserve neuroimaging, preferably with CT/CTA in urgent cases but followed by MRI/MRA if the CT/CTA is negative because MRI is superior to CT for non-aneurysmal causes of third

nerve palsy. Standard catheter angiography may still be necessary in equivocal cases in which the CT/CTA or MR/MRA combination is inadequate to exclude aneurysm.

If an aneurysm (typically posterior communicating artery) is present, referral to neurosurgery and/or endovascular neuroradiology is advised and the aneurysm may be clipped or coiled.

Isolated fourth-nerve palsy can be associated with trauma because it is the only cranial nerve that exits the brainstem dorsally, which renders it susceptible to axonal shear injury during trauma, especially in coup-contrecoup contusions.

Fourth-nerve palsy may also result from decompensation of a congenital fourth-nerve palsy. This can sometimes be determined using prisms to measure fusional amplitudes. Congenital palsies have greater vertical fusion (up to 6 D) in general. Imaging and further evaluation should be considered in any unexplained, progressive, non-isolated or atypical cases.

Sixth-nerve palsies can be caused by a non-localised sign of increased intracranial pressure. Downward shift of the brainstem is believed to stretch or compress the nerve as it travels in the subarachnoid space along the clivus. Sixth-nerve palsy with Horner syndrome can localise to the cavernous sinus (i.e., Parkinson syndrome)—in which case, imaging should be considered.
Horner syndrome

Horner syndrome refers to a constellation of symptoms classically presenting as a triad of ptosis, miosis and anhidrosis ipsilaterally. This condition results from damage to a segment of the three-neuron chain that originates in the hypothalamus (first-order neuron), travels downwards through the brainstem to the spinal cord (second-order neuron), and returns upwards to synapse in the superior cervical ganglion (third-order neuron) before continuing on the internal carotid artery to the cavernous sinus and then to the iris and the Mueller muscle in the eyelid (Figure 5).10

While many causes of Horner syndrome are idiopathic and benign or iatrogenic (e.g., open-heart or neck surgery), there are more other causes that may warrant further workup; these can include aneurysm, malignancy, posterior circulation infarct and carotid or vertebral dissection.

Establishing the duration of symptoms is important for diagnosis, as well as collecting a thorough medical and surgical history. Reviewing a patient’s driver’s license or other old photographs may provide a baseline. Recognition of the classical triad often guides the diagnosis. Because other conditions may cause anisocoria or ptosis, testing with 0.5% apraclonidine in both eyes can differentiate Horner from other etiologies by causing the affected eye to dilate and the ptosis to reverse while causing minimal change in the unaffected eye. Cocaine drops may also be used if apraclonidine is unavailable or contraindicated.

Further testing with hydroxyamphetamine can localise the lesion; a preganglionic lesion will dilate normally in response to hydroxyamphetamine but a post-ganglionic lesion will not dilate as well as the normal pupil. Imaging of acute Horner requires an MRI of the sympathetic pathway from the hypothalamus to thoracic vertebrae 2 (T2), and in the acute setting headband neck CT and CTA to rule out carotid dissection.

The most concerning causes of Horner syndrome include malignancy, stroke, carotid dissection and aneurysm.

As the three-neuron chain travels in close proximity to the apex of the lung and to structures in the neck, Pancoast tumours and thyroid tumours, as well as metastases to these regions, may produce Horner syndrome. In children, neuroblastoma is most commonly associated with Horner syndrome.

Stroke in the lateral medulla (Wallenburg syndrome) may also produce Horner syndrome but is usually accompanied by other medullary signs.

In contrast, Horner syndrome associated with carotid dissection may be isolated or only accompanied by neck pain.

As the dissection may generate thrombotic emboli, neuroimaging is indicated (e.g., CT/CTA or MRI/MRA of the head and neck) and patients should be offered anticoagulation or antiplatelet therapy.

Treatment should be directed toward the etiology of the Horner syndrome.

Conclusion

Neurologists may be the first or only clinicians to see potentially dangerous neuro-ophthalmologic conditions. They should be able to triage and recognise the key differentiating features of IIH, AION, ON, ocular motor cranial neuropathy and Horner syndrome. Early diagnosis and treatment of these conditions may be potentially life or vision saving.

Editor’s Note: This article originally appeared in our sister publication, Neurology Times.
FDA approves personalised LASIK platform

Johnson & Johnson Vision recently announced the US FDA approval of its topography-integrated, wavefront-guided technology, iDESIGN Refractive Studio, for measuring the refractive errors myopia, hyperopia and mixed astigmatism.

Treatment using the technology begins with a wavefront analysis to measure how light travels inside the eye, detailing the imperfections in a patient’s vision. The corneal topography scans the outside surface of the eye, measuring and analysing tiny variations in curvature and elevation. The combination of the two measurements delivers a custom LASIK procedure tailored for each eye.

In a press release, the company pointed out that the system is the only available LASIK platform indicated for monovision LASIK in presbyopic myopic patients.

“As a practicing ophthalmologist for more than 25 years, I know first-hand the importance of taking precise measurements and tailoring LASIK procedures for each patient,” said Dr Jonathan Talamo, chief medical officer and worldwide vice president of Medical and Clinical Affairs, Johnson & Johnson Vision.

The majority of patients see 20/16 or better six months after laser vision correction based on clinical studies, the company stated. The device will be available in Q3 2018.

See: www.jnjvisioncare.co.uk

Quantel Medical launches new retinal laser

Quantel Medical has launched a new 532-nm retinal photocoagulation laser, Vitra 2.

In a press release, the company stated: “Vitra 2 includes all the key elements that have made the success of the Vitra photocoagulator, such as reliability, compactness and versatility.”

Quantel listed the improvements and new functionalities as being:

- A new generation of optimised laser cavity with an increased maximum power level. It is also now compatible with single spot and multi spot technologies
- A new, easy-to-use clinically-oriented software interface, designed to simplify the treatment procedures and the doctors’ workflow owing to printable treatment reports.
- Compatibility with split lamps (for example, Haag Streit’s), and can be connected to a wide range of delivery systems (operating microscopes, laser indirect ophthalmoscopes and laser probes).

See: www.quantel-medical.com

Outer space OTC upgrade set to improve microgravity research

Heidelberg Engineering recently announced that its ophthalmic imaging platform, Spectralis, will be installed on the International Space Station (ISS) in late 2018, as NASA continues to investigate the effects of microgravity on vision.

NASA’s researchers have used this technology for its microgravity research since 2013. Whilst the existing device continues to function normally on the ISS, the next-generation technology will optimise acquisition speed and capture more complex scans, while considering use of additional modalities such as OCT angiography, anterior segment imaging, ultra-widefield fundus imaging and multicolour, Heidelberg pointed out in a press release.

“Upgrading to the OCT2 Module allows NASA to gain greater understanding of space flight associated neuro-ocular syndrome (SANS), a condition astronauts commonly experience as a result of space flights,” said Dr Alex Huang, assistant professor, Department of Ophthalmology, David Geffen School of Medicine, University of California, Los Angeles, United States.

“SANS can cause unilateral and bilateral optic disc oedema. In association with the oedema, globe flattening, choroidal and retinal folds, refractive error shifts and nerve fibre layer inﬁrcts have also been noted.”

NASA incorporated the technology aboard the Antares 230 Cygnus CRS OA-9, also known as Orbital Sciences CRS Flight 9E, on May 21, 2018 at Wallops Island, Virginia, US.

“The Spectralis with OCT2 Module uses patented TruTrack Active Eye Tracking,” said Ali Tafreshi, Director of Clinical Research for Heidelberg Engineering. “The technology uses a second laser beam to actively track the eye during OCT scanning to effectively ‘freeze’ the retina and avoid motion artifacts. With this technology, a precise OCT image can be captured, even if the subject blinks or moves.”

See: www.heidelbergengineering.co.uk
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