INNOVATIONS IN IOL TECHNOLOGY

Benefits of trifocal IOLs in presbyopia

Positive results reported for near, intermediate and distance vision

In a recent study, Trifocal IOLs were implanted in 111 eyes of 67 patients. (Figure courtesy of Dr. Piovella)
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Helping the underprivileged to see

The logistical decisions that need to be made when setting up ‘eye camps’

By Dr Christoph Faschinger
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Dr Faschinger has been an ophthalmologist for 40 years at the Department of Ophthalmology of the Medical University of Graz, specialising in anterior segment surgery (cataract, glaucoma, keratoplasty). He is founder of the association “Vision without Frontiers”, which encompasses almost 40 eye camps in several developing countries.

Roughly 300 million people are visually impaired—38 million of whom are blind and most of whom live in so-called developing countries. However, there are many institutions with specific campaigns aimed at eliminating preventable blindness (for example, the World Health Organization’s ‘Vision 2020: The Right to Sight’ initiative), as well as associations (Lions, Rotary, Surgical Eye Expeditions, Orbis, Mercy Ships, Sight Savers and CBM to name but a few). Additionally, donation appeals fill post office boxes regularly.

In 1997, my friend and I, both ophthalmologists for more than 15 years at that time with plenty of surgical experience, travelled to Papua New Guinea to take part in a surgical eye camp under the auspices of Surgical Eye Expeditions (Santa Barbara, California, United States). Unfortunately, we were unsuccessful in achieving our goals, which was mostly down to issues such as the lack of infrastructure (microscopes, autoclaves), consumer goods (syringes, needles, drapes, etc.) and trained surgical nurses.

Therefore, we decided to found our own association, which we called “Vision without Frontiers” (www.sehenohnegrenzen.org), to gain donated money to optimise the outflow of an eye camp in 2000. We organised 41 eye camps in Namibia, Zambia, Zimbabwe, Tansania, Nigeria and Nepal.

Our responsibilities lie in creating or improving the infrastructure at the location where the camp is planned. This means perfect microscopes (not fixed on the operating table) are required, as well as at least two autoclaves and supporting kitpacks (including drapes, sutures, syringes, needles, patch, gowns, gloves, cannulas, knives, keratomes, infusion sets, etc).

We also need to source staff, and it proves quite a challenge to find skilled colleagues and nurses who are physically and mentally strong enough to travel to unknown countries with unfamiliar potentially harmful diseases in their holiday time.

One of the most important persons for a successful camp is the host, who is usually an ophthalmologist who does surgery as well. He or she is responsible for a wide range of tasks including recruiting enough patients for surgery; bringing them to the clinic or an adapted ‘operation’ room; organising facilities for surgery; and ensuring the power supply for microscopes and autoclaves.

Costs have to be factored in from the beginning. For example, the price of transporting equipment from Europe to Africa, including surgical instruments for phaco and ECCE; IOLs; a keratometer; an ultrasound biometer; and several drugs, ointments, local anaesthetics, hylase and eye drops. These will all have to pass customs and be transported to the camp in a timely manner.

Last year we were invited to build an eye camp in a rural town in Nigeria, where a small hospital exists. The costs for infrastructure were €125,000 Euros, for consumables €20,000 and for logistics €20,000.

Our team comprised two doctors, four nurses and two ‘helping hands’, and we performed 139 cataract surgeries within 5 days. Thus, the cost of a single surgery was about €1,200.

However, this high price is expected to decrease over time as the number of eye camps in the country increases. In addition, at this camp a young Nigerian doctor is currently undergoing surgical training and will soon overtake this duty, so sustainability is guaranteed.

Wanting to help deliver ophthalmic care in developing countries is a wonderful idea, but the reality is that costs can be higher than expected, especially at the beginning and because of the high-quality work carried out. This has to be taken into account before you start.

However, whether it’s through the setting up of camps, donating your time or channelling your money to such worthwhile causes, enabling a patient to see again is worth almost any price.
How to minimise errors, improve IOL power calculations in keratoconus

Inaccuracy can be minimised by using an adjusted keratometric approach

By David P. Piñero, PhD, Vicente J. Camps, PhD and Esteban Caravaca-Arens, PhD

One source of error in IOL power calculation is the use of the classical keratometric approach for the characterisation of the corneal optics. This approach is based on the assumption of only one corneal surface and a fictitious index of refraction (keratometric index, $n_k$) for obtaining an estimation of the corneal power ($P_k$).

Specifically, the use of the classical value of $n_k$ of 1.3375 has been shown to overestimate the corneal power in healthy, post-laser refractive surgery and keratoconus eyes. Some algorithms that have been developed, for different types of IOL design in eyes with corneal problems or previous surgeries, minimise the impact of this keratometric error in IOL power calculations. There are also algorithms for optimising the estimation of the effective lens position (ELP).

To this date, few studies have been conducted to investigate how to optimise IOL power calculation in keratoconus eyes. It should be considered that the posterior corneal curvature and thickness is abnormal in this type of eyes.

Park do and colleagues found that, in patients with posterior keratoconus, IOL power calculations from conventional keratometry may be inaccurate and secondary piggyback IOL procedures might be needed after cataract surgery. Thebpatiphat and co-authors concluded in a retrospective cases series evaluating 12 keratoconus eyes undergoing cataract surgery that IOL calculation was more predictable in mild keratoconus than in moderate and severe disease.

It should be considered that the most significant increase in posterior corneal curvature and decrease in central corneal thickness are present in more severe keratoconus cases compared with the rest. We have recently conducted a simulation and clinical study to investigate the influence of the error in the calculation of corneal power due to the use of $n_k$ on IOL power calculation, as well as the potential benefit of using adjusted keratometric algorithms.

**Our simulations**

We have found that IOL power is underestimated if corneal power is overestimated, and vice versa. In our simulations, the use of the classical keratometric approach with a keratometric index of 1.3375 led to overestimations of IOL power up to -5.6 D and -6.2 D using Le Grand and Gullstrand eye models, respectively.

An adjusted keratometric approach was defined by our research group consisting of the use of a

**IN SHORT**

- The use of the classical keratometric approach with a single value of $n_k$ in keratoconus, for the calculation of IOL power, is inaccurate and may be the reason for some refractive surprises in this type of eyes after cataract surgery.
variable $n_k$, which was dependent on the radius of curvature of the first corneal surface and the eye model used, as summarised in Table 1. With this adjusted keratometric approach, maximal error was within ±1.1 D, with most values ≤ ±0.6 D.

Considering that 1 D of variation of IOL power induces about 0.9 D of change in subjects’ refraction at the corneal vertex, this error can be considered as clinically acceptable, with most of cases not exceeding ± 0.60 D for most $r_{1c}$-$r_{2c}$ combinations. Only the error was maximal for extreme values.

**Preliminary clinical validation**

A total of 13 eyes of 8 patients with keratoconus (with a mean age of 41.1 years ± 19.1 and ages ranging from 20 to 69 years) were evaluated in the Department of Ophthalmology (OFTALMAR) of the Vithas Medimar International Hospital (Alicante, Spain). In all cases, IOL power was calculated using the keratometric approach (equation 1) and the complete Gaussian formula, including posterior cornea and pachymetric data obtained with the Sirius system (CSO; Firenze, Italy).

The agreement between both IOL power calculation methods was studied. The adjusted keratometric IOL power was calculated as follows:

$$P_{\text{adj}} = \frac{n_w}{\text{AL} - \text{ELP}} \left( \frac{n_w}{R_{\text{in}} + \frac{n_w}{r_i} - \text{ELP}} \right)$$

where $P_{\text{adj}}$ is the IOL power estimated with the keratometric approach; $h_{\text{in}}$ the refractive index of the vitreous humour; $n_w$ the refractive index of the aqueous humour; AL the axial length; ELP the effective lens position; $n_k$ the keratometric index; $r_i$ the radius of curvature of the first corneal surface; and $R_{\text{des}}$ the desired postoperative spherical equivalent refraction.

In agreement with theoretical simulations, the IOL power calculated with the adjusted keratometric approach underestimated and overestimated the IOL power calculated using the Gaussian equation in a magnitude ranging from -1.1 to 0.4 D. No statistically significant differences between both IOL power calculations were found ($p > 0.05$) and a very strong and statistically significant correlation between them was observed ($r = 0.99, p < 0.01$).

The Bland-Altman analysis revealed the presence of a mean difference between adjusted keratometric and Gaussian corneal power of -0.31 D, with limits of agreement of -1.34 and 0.72 D (see Figure 1).

**Conclusions**

The use of the classical keratometric approach with a single value of $n_k$ in keratoconus for the calculation of IOL power is inaccurate and may be the reason for some refractive surprises in this type of eyes after cataract surgery.

This inaccuracy can be minimised by using an adjusted keratometric approach based on the estimation of the keratometric corneal power, using a variable $n_k$ depending on the radius of curvature of the anterior corneal surface, with a maximum error in most of cases of approximately 0.6 D.
The Bland-Altman analysis revealed the presence of a mean difference between adjusted keratometric and Gaussian corneal power of -0.31 D, with limits of agreement of -1.34 and 0.72 D.

0.6 D and over 1 D in very few cases.

We have conducted a successful preliminary clinical validation of this approach for IOL power calculation, and a clinical validation with a larger sample size including severe keratoconus cases is now necessary so that more consistent conclusions can be obtained.

REFERENCES


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Multifocal lens maintains distance dominance with familiar platform

Device offers expanded patient pool for low, medium, high levels of astigmatism

Presbyopia patients have changed: they are younger, more active and have more treatment options than ever.

“There is an intense amount of interest in helping our patients who have cataract surgery to lessen their dependence on glasses postoperatively,” said Dr Bret L. Fisher, medical director, Eye Center of North Florida, Panama City, Florida, United States. “We have been looking for lenses that offer solutions for our patients without too much compromise and that allow them a full range of vision without causing other problems.”

New design
A new lens design (AcrySof IQ ReStor +2.5 D IOL, an ActiveFocus lens, Alcon Laboratories) offers patients full-distance vision plus intermediate vision as close as 21 inches.

“This is the first multifocal lens implant that is truly distance dominant with 100% distance vision in its centre portion,” Dr Fisher added.

Surgeons recognise that meeting patient expectations is vital. A 2015/2016 survey by Brand Health Tracker found that surgeons ranked high patient satisfaction as the most important attribute of a presbyopia-correcting IOL.

The next most important attributes were delivering on patient expectations and optimised distance vision. Optimised near and intermediate vision were numbers 10 and 13, respectively.

The IOL’s 0.938-mm central portion design optimises distance vision. The central portion is surrounded by an apodized diffractive multifocal zone with a second distance zone at the periphery.

This large peripheral zone allocates more light to distance as the pupil size increases. The new design allocates 69.4% of available light to distance vision and 18% to near vision, for a total light distribution of 87.4%.

Seven steps
The lens has seven diffractive steps across a diffractive region 3.4 mm in diameter and an area of 8.4 mm². Negative asphericity is -0.2 μm.

The IOL can be a good choice for patients who have a more active lifestyle, including individuals who participate in sports, attend events, or anyone who wants to use a computer.

The same lens might be helpful for patients who want more than monofocal vision or prefer an alternative to monovision. It could also be helpful for those who want less spectacle dependence after surgery.

“For close reading or small-print reading, some patients may require mild over-the-counter reading glasses on a part-time basis,” he said.

Fewer night-vision issues
Night-vision disturbance has been a concern with presbyopia-correcting IOLs, he continued. Halos around point sources, such as headlights and street lights, are a recognised problem every surgeon must answer.

IN SHORT
- A new lens design offers patients full-distance vision plus intermediate vision as close as 21 inches.
“With [this lens], we are seeing the least amount of night-vision disturbance that we have seen with any of the lenses that offer an expanded range of vision,” he said. “There are definitely some flares, but most patients describe them as mild and they tend to improve with time as patients adapt to their lenses.”

As with other IOLs, surgeons must be attentive to managing astigmatism in order to achieve optimum results.

“All types of presbyopia-correcting lenses require meticulous surgery,” he cautioned, “but this one is very user-friendly.”

One of the advantages is the relative flexibility in patient selection. The platform can be used in patients with low, medium and high astigmatism.

“This lens is a bit more tolerant of dry eye, maybe a bit of aging-related changes to the retina, a little bit of mild glaucoma, even a bit of leftover astigmatism than the older generations of multifocal lenses,” Dr Fisher said. “We can offer it to more people than we could before and, with good patient selection, be very confident we are going to make them happy.”

Dr Bret L. Fisher, MD
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Dr Fisher is a consultant to Alcon Laboratories.

A new multifocal lens design may be an ideal choice for patients with an active lifestyle.

(Photograph courtesy of Alcon Laboratories)

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Small-aperture IOL offers extended depth of focus, high satisfaction

A new small-aperture intraocular lens (IOL) extends patients’ depth of focus as well as multifocal IOLs with fewer dysphotopsias, researchers say.

In a prospective, open-label trial, the AcuFocus IC-8 improved patients’ uncorrected distance visual acuity to 20/23, their uncorrected intermediate visual acuity to 20/24 and their near visual acuity to 20/30 in the implanted eyes.

“The IC-8 IOL is a great lens that is highly versatile,” said Burkhard Dick, chairman of the University Eye Hospital Bochum, Germany and principal investigator of a prospective, open-label trial of the AcuFocus product published in the July issue of the Journal of Cataract & Refractive Surgery.

“The pinhole only allows central focused light to reach the retina and blocks peripheral defocused light that degrades image quality. This results in a high quality, extended depth of focus without blurry transition zones.”

The IC-8 is a 1-piece hydrophobic acrylic posterior chamber IOL with an optic that contains an embedded mask with a 1.36 mm central aperture. The dimensions of the mask and aperture contained within the optic are based on that of the AcuFocus Kamra corneal inlay, with a smaller diameter and flatter radius of curvature to account for its more posterior placement within the eye.

It is CE Marked and currently available in some European and Asia Pacific markets. The company plans to start a U.S. clinical trial in 2018.

The small-aperture lens will compete with multifocal and trifocal IOLs. These lenses provide good functional vision, but with the drawbacks of reduced contrast, visual disturbances and noncontinuous range of vision.

To test the small-aperture lens, Dr Dick and his colleagues implanted it in one eye each of 114 patients while implanting the fellow eyes with a variety of aspheric monofocal IOLs.

At 6 months, 105 patients were available for follow-up. Their mean age was 67.5 years and 57.1% were women. The mean uncorrected distance visual acuity in the eyes implanted with small aperture lens improved from 0.57 to 0.06 logMAR. Mean uncorrected intermediate distance visual acuity improved from 0.66 to 0.08 logMAR. Mean uncorrected near visual acuity improved from 0.75 to 0.18 logMAR.

By comparison, the uncorrected distance visual acuity in the eyes implanted with the monofocal lenses improved from 0.61 to 0.03 logMAR. Uncorrected intermediate visual acuity in these eyes improved from 0.64 to 0.30 logMAR and uncorrected near visual acuity improved from 0.71 to 0.51 logMAR.

Binocular uncorrected distance visual acuity at 6 months was -0.056 logMAR, uncorrected intermediate vision was 0.043 logMAR and near vision was 0.160 logMAR.

By blocking peripheral defocused light rays, the small-aperture lens not only provides depth of focus, it also reduces dysphotopsias, particularly

IN SHORT

Professor H. Burkhard Dick highlights a prospective multicentre trial of a small-aperture IOL in cataract surgery, in which the device showed excellent visual performance, safety, patient satisfaction and tolerance to residual astigmatism 6 months after implantation.
for patients with aberrated corneas like post-refractive or keratoconic patients, Dr Dick said.

It also provides tolerance to corneal astigmatism up to 1.50 D and a functional range of vision even if the refractive target is missed by as much as 1.00 D MRSE, he said.

“Thus, it would be inaccurate to say that there are zero complaints of glare or halo, but the incidence and severity seem to be by far much less than other multifocal IOLs based on my personal experience,” said Dr Dick.

In the study, patients rated their visual symptoms on a scale of 0 to 5 where 0 was no symptoms, 1 was very mild and 5 was very severe. They rated blurry vision a mean of 1.09, fluctuating vision 1.0, dry eye 1.4, glare 1.4, halo 1.1, double vision 0.2 and ghost images 0.1.

The researchers performed mesopic contrast sensitivity testing in a subgroup of 36 patients. The eyes with the monofocal IOL had significantly better contrast sensitivity than the eyes with the small-aperture IOL at 1.5 cpd, 3.0 cpd, 6.0 cpd and 12.0 cpd.

Binocular contrast sensitivity without glare in eyes with the small-aperture IOL, was similar to that in eyes with the monofocal IOL at all spatial frequencies.

Eyes with the monofocal IOL had significantly better monocular mesopic contrast sensitivity with glare than eyes with the small-aperture IOL eyes at 1.5 cpd, 3.0 cpd and 6.0 cpd. At 12.0 cpd, the difference in contrast sensitivity between eyes with the small-aperture IOL and eyes with a monocular IOL was not statistically significant.

The 114 enrolled patients experienced 14 ocular adverse events: nine in eyes with the small-aperture IOL and five in eyes with the monofocal IOL. The only serious adverse event was one case of persistent macular oedema in an eye with the small-aperture IOL, but researchers did not consider it to be related to the device.

Overall, 88.5% of patients said they were satisfied, 5.5% were neutral and 5.8% were dissatisfied.

The small-aperture IOL appears to offer some advantages over other IOLs designed to correct for presbyopia, said Dr Dick. With multifocal lenses, the patient has to interpret in-focus images on top of out-of-focus images as the various optical zones focus light to different focal points, he explained. “As a result, these lenses can achieve good vision at specific foci, however, with the determent of visual symptoms. The IC-8 IOL, with its small aperture, provides a continuous extended depth of focus that doesn’t overlay in-focus and out-of-focus images.”

The small-aperture IOL also provides a more complete range of vision than bifocal lenses, he said. “Compared to trifocal IOLs, the near focal point with the IC-8 IOL may not be quite as close, however the quality of vision with the IC-8 IOL is better.”

In addition to cataract patients who don’t want to use reading glasses, the lens is increasingly being used for patients who have undergone refractive surgery and in challenging eyes like iris trauma and keratoconic patients, and in complex cataract cases to decrease dysphotopsias, said Dr Dick. “The lens can truly benefit a broad spectrum of patients.”

However, he cautioned that it is contraindicated in patients with untreated ocular surface disease, macular diseases or proliferative retinal disease.

Before surgery, he points out to patients that the lens is used monocularly and is paired with a high quality monofocal IOL in the fellow eye. “If patients cover one eye and then the other to compare the different lenses, they may notice some differences in dimness between eyes,” he says. “Patients should be encouraged not compare eyes as this will delay their natural adaption.”

Researchers are now evaluating the lens’s potential for bilateral implantation, he said.

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The study was supported by AcuFocus. Dr Dick is a member of the Acufocus Inc. medical advisory board.
Innovations in IOL technology

Study finds advantages with using a trifocal IOL to correct presbyopia

Positive results reported for near, intermediate and distance vision

By Vanessa Caceres

Reviewed by Dr Matteo Piovella

A 4-year study following trifocal IOL implantation found that the AT LISA tri 839MP (Carl Zeiss Meditec) provided good distance, near and intermediate visual acuity. The lens also improved patient quality of vision with better diffraction and less reduction in contrast sensitivity, said Dr Matteo Piovella, MD, medical director, Centro Microchirurgia Ambulatoriale – CMA in Monza, Milan, Italy.

Dr Piovella presented his study on the AT LISA tri 839MP at the annual ASCRS Symposium in Los Angeles, United States, earlier this year. The coauthor of the study is Dr Barbara Kusa, also from Centro Microchirurgia Ambulatoriale.

Their study, starting in 2012, included 111 eyes of 67 patients who had phacoemulsification and trifocal IOL implantation of the AT LISA lens. All surgeries were uncomplicated. Distance (5 m), near (40 cm) and intermediate (80 cm) visual acuity were measured after surgery, as well as corneal topography, contrast sensitivity and defocus curve. The follow up period was 4 years.

The study included 111 eyes from 67 patients, with a mean age of 67 years. The preoperative distance uncorrected visual acuity (UCVA) was 20/125 (0.8 logMAR), compared with 20/20 at 4 years postoperatively. The monocular and binocular uncorrected near vision was 0.06 and 0.02 logMAR, respectively. Monocular and binocular intermediate vision was 0.13 and 0.09 logMAR, respectively. Nearly 8% of patients still wear glasses occasionally.

By the year 2015, 73% of patients having cataract surgery at CMA surgical centre received the AT LISA trifocal technology. “Ninety four percent of eyes achieved postoperative refractive results within ± 0.50 diopters,” Dr Piovella reported.

“In practice, intermediate vision is the most important vision because of iPad, smartphone and computer use,” Dr Piovella said. He was surprised that the trifocal is the only technology submitted and approved to provide effective far, intermediate and near vision. Although extended depth-of-focus IOLs are available, their strengths are only far and intermediate vision, he said.

Regarding trifocal IOLs, “if you learn to improve your preoperative organisation to provide plano refractive results by doing a perfect biometry analysis, then every patient is happy,” Dr Piovella said.

However, surgeons using the trifocal must provide dry eye therapy to ensure optimal ocular surface health, he said. His study found that over 16% of patients required pre- and postoperative dry eye management.

Dr Piovella himself was implanted binocularly with the AT LISA trifocal IOL.

Dr Piovella is involved in a study on a trifocal toric IOL based on the same platform, which should be in press soon, he added.

In short

In a European study, a trifocal IOL provided effective visual improvements at near, intermediate and far distances.
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Preoperative considerations with EDOF lenses in presbyopic patients

Careful patient selection and preoperative measurements are important

By Dr Sumit “Sam” Garg

Extended depth-of-focus (EDOF) IOLs are an exciting new option for presbyopic patients (Figure 1). Although these lenses tend to be more forgiving of residual refractive error and mild decentration than other presbyopia-correcting IOLs, it is still important to select patients carefully and follow good preoperative protocols to maximise the chance of a successful outcome.

Patient selection and counselling

When starting out with EDOF lenses, I recommend selecting uncomplicated cases (e.g., no concomitant ocular disease or prior surgery) at first, with the aim of building confidence in the lens. Choose patients with bilateral cataracts so that you can give them the same optics in both eyes. Certainly, EDOF lenses can still be a good option for a patient with unilateral cataract or for a post-LASIK eye—but save those cases for later, if possible.

In my experience, EDOF lenses provide a very functional range of vision for patients who still have active lives and want to be less dependent on spectacles for their daily activities. However, it’s important not to mislead patients that their vision will be perfect. I tell patients to expect they will still need glasses for some tasks, such as small print or prolonged reading. I also talk about glare, halo and starbursts. I explain that the incidence is lower and the symptoms seem to be less bothersome than with multifocal IOLs, but they may still experience some night vision symptoms. Patients who seem like they will not be able to tolerate any night vision symptoms at all might be better served with a monofocal IOL.

Early on, I implanted a Symfony EDOF lens in a hyperopic attorney who I later realised would have benefited from a more in-depth preoperative conversation about the potential for starbursts while driving at night. Ultimately, he was satisfied with his vision and didn’t want to give up the spectacle independence that he enjoyed, but it would have been easier on both of us if I had confirmed what he understood about the possibility of having night-time starbursts.

Preop measurements and power calculation

A healthy ocular surface is important for success with any refractive IOL, so it is a good idea to set the stage months (if not years) before cataract surgery by counselling patients about therapy and prevention as soon as there are early signs of ocular surface disease. During initial consultation, I emphasise that early treatment can make a difference in their future vision after

IN SHORT

» Though extended depth-of-focus lenses tend to be more forgiving of residual refractive error and mild decentration than other presbyopia-correcting IOLs, it is important to select patients carefully and follow good preoperative protocols for a successful outcome.
Innovations in IOL technology

ISSUE FEATURE

By DR Sumit “Sam” Garg, MD

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Innovations in IOL technology

EDOF lenses are more forgiving of residual refractive error (Figure 2), but it is still important to be meticulous about preoperative measurements and management of astigmatism. Compare topography and tomography to make sure that any astigmatism is regular and relatively consistent, and obtain optical coherence tomography (OCT) imaging to help identify any macular pathology. I also watch for subtle conditions such as Fuchs’ dystrophy, anterior basement membrane dystrophy and amblyopia, and perform a pinhole near vision test to ensure that there are no non-refractive issues that could affect visual outcomes.

My A-constant for the Symfony lens is 119.35, very similar to that of the Tecnis monofocal. For power calculation, I prefer the Barrett Universal Formula or the Barrett Toric Calculator, which helps ensure that posterior corneal astigmatism is taken into account. I also perform intraoperative aberrometry on most of my patients.

I always test for eye dominance, because I prefer to operate on the dominant eye first and try to maximise distance vision in that eye. I like to centre the IOL on the patient-fixated coaxially sighted corneal light reflex but it is also comforting to know that clinical studies have shown that these lenses perform well with up to 0.75 D of decentration. That means we really don’t have to be as concerned about eyes with higher angle kappa.

I recommend waiting a few weeks after implanting your first EDOF lenses to evaluate the initial outcomes. In my early cases, the Day 1 outcomes were slightly myopic, which at first led me to believe my power calculations might be off. However, I found that patients settled toward emmetropia within two weeks.

As with any other premium lens, patient counselling and good measurements are critical to good outcomes with EDOF lenses. In order to really embrace this technology, it’s important to have a good early experience, so choose your cases wisely and invest the time to take a careful approach preoperatively.

Dr Sumit “Sam” Garg, MD

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Patient satisfaction is the name of the game in any refractive procedure. This is especially true in the correction of presbyopia. An investigational device for presbyopia (VisAbility Micro-Insert System, Refocus Group) is showing to be satisfying for both patients and surgeons with minimum increases of two lines of distance-corrected near visual acuity (DCNVA) and the added bonus of improvement in near visual acuity that increases with time.

Dr Y. Ralph Chu, of the Chu Vision Institute, Bloomington, Minnesota, United States, and his colleagues observed these findings in a single-centre, subgroup analysis that was part of a prospective investigational device exemption (IDE) trial of the implant conducted at 13 sites.

**IN SHORT**

- Implantation of an investigational device for presbyopia resulted in a minimal two-line increase in distance-corrected near visual acuity and an actual reduction in the amount of near add needed over time, show findings from a single-centre, subgroup analysis.
The device is a scleral implant, which, once in place, increases the space around the ciliary muscle—thus reducing crowding of the muscle and increasing the ciliary muscle function with resultant accommodation, Dr Chu noted.

Subsample analysis results

The subsample analysis—the goal of which was to evaluate the 12-month safety and effectiveness of the device for improving DCNVA in patients with presbyopia (the primary endpoint)—included 20 eyes of 10 patients (7 men, 10 women). They were a sample of 68 patients who underwent implantation of the device at the surgical site.

These 10 patients, according to Dr Chu, were early surgical subjects from the Chu Vision Institute, an IDE clinical research site.

The mean age of the patients at surgery was 53.3 years (range, 46 to 57 years). The mean MRSE was +0.181 D (range, –0.25 to +0.50 D). The baseline monocular average DCNVA was 20/64.2 (range, 20/50 to 20/80) and the binocular average was 20/51.6 (range, 20/25 to 20/80).

Nineteen of the 20 patients completed the final evaluation at 12 months.

At that time point, Dr Chu noted, all patients achieved DCNVA of 20/40 (J3) or better, and 85% achieved DCNVA of 20/32 (J2) or better. Regarding UCNVA, all patients achieved 20/40 (J3) or better and 90% achieved UCNVA 20/32 (J1) or better.

Interestingly, the investigators observed a decrease in the mean near-add requirement of 1.02 D, down from 1.49 D at baseline to 0.47 D at the final evaluation.

“Almost all patients gained at least two lines of DCNVA,” Dr Chu said. “The near visual improvements appeared to increase over time. The patients were highly satisfied with the procedure and the results.”

He added that this subsample evaluation of patients at a single centre participating in a multi-centre clinical trial suggested that the implant system might provide near-vision correction with a corresponding reduction in the amount of refractive add needed to achieve an optimal DCNVA.

DR Y. RALPH CHU, MD
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This article was adapted from Dr Chu’s presentation at the 2017 meeting of the American Society of Cataract and Refractive Surgery. Dr Chu is a clinical investigator in the VisAbility trial. The device is under a U.S. investigational device exemption through Refocus Group. The device is CE marked and available in Europe through Refocus Ocular BV, the Netherlands.

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PiXL appears promising for low myopia

Epi-on method reduced myopia; effect averaged 1.25 D in high oxygen

By Vanessa Caceres
Reviewed by Dr Anders Behndig

Photorefractive intrastromal crosslinking—or PiXL for short—may be a potential new treatment for low-grade myopia, according to Dr Anders Behndig, Department of Clinical Sciences/Ophthalmology, Umeå University Hospital, Umeå, Sweden.

Dr Behndig presented information about his ongoing study, which included healthy volunteers with myopia in the range of −0.5 and −2.6 D (mean, −1.5 D).

All volunteers had epithelium-on (epi-on) PiXL treatment. This treatment included the use of topical anaesthesia, isotonic riboflavin that was applied every 90 seconds for 10 minutes, and pulsed crosslinking. A circular central 4-mm cornea zone was irradiated with 30 mW/cm² for 16:40 minutes.

Two groups

“Thirty-nine eyes of 20 patients were treated, of which 12 eyes were treated in room air (20% O₂) and 27 eyes in 94.3% O₂, which was the high-oxygen group,” Dr Behndig said.

The groups represented six patients and 14 patients, respectively.

Dr Behndig collected information on uncorrected visual acuity (UCVA), subjective refraction, spherical equivalent and corneal endothelial cell count.

A minor increase in spherical equivalent was seen in the room air group at 1 month (+0.33 D). “The UCVA increased by 0.13 and 0.60 logMAR, respectively,” Dr Behndig said. “In the high-oxygen group, the UCVA at 1 month was 0.11 logMAR.”

He did not observe any reduction in endothelial cell count or other adverse effects.

“Based on the preliminary results of this ongoing study, a reduction of myopia of about 1 D can be achieved with a 4-mm epi-on PiXL treatment of 15 J/cm² in a high-oxygen environment,” Dr Behndig concluded.

Although the approach is safe, he added that it requires fine-tuning both to boost the effect of the treatment and to reduce variability.

IN SHORT

- The use of epi-on photorefractive intrastromal cross linking reduced myopia by about 0.25 D in a small study; in a high-oxygen group, the effect averaged 1.25 D.

Results

UCVA (LogMAR)

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<th>Room air</th>
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(FIGURE 1) In the high-oxygen group, the uncorrected visual acuity at 1 month was 0.11 logMAR. (Figure courtesy of Dr Anders Behndig)

Dr Anders Behndig, MD
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This article was adapted from Dr Behndig’s presentation at the European Society of Cataract and Refractive Surgeons’ Winter Meeting in Maastricht, the Netherlands. Dr Behndig is a consultant for Avedro.
It's Time to make a Move

It has never been so simple to adapt new technology into your daily workflow. The truly mobile FEMTO LDV Z8 finally enables you to use next generation femtosecond laser technology for your cataract and refractive surgeries.

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Hyperopic small-incision lenticule extraction (SMILE) performed using a proprietary femtosecond laser (VisuMax, Carl Zeiss Meditec) is feasible and, in early experience, associated with refractive and visual acuity results similar to those achieved with LASIK, said Dr Dan Z. Reinstein.

“Compared with LASIK, SMILE brings potential advantages to hyperopic correction, including maintaining integrity of the corneal nerve plexus, which is particularly important considering that hyperopes tend to be older patients,” said Dr Reinstein, medical director, London Vision Clinic, London, and adjunct professor of ophthalmology, Columbia University Medical Center, New York, United States.

The original attempt at treating hyperopia using femtosecond lenticule extraction was associated with poor safety and significant regression, but the treatment was performed using a 5.5-mm optical zone and no transition zone. Safety and stability were much better in a subsequent small series treated with a 5.75-mm optical zone and a 2-mm transition zone, he noted.

“The lenticule shape for hyperopic SMILE has been further optimised, and initial results are encouraging,” he said. “We are in the process of treating more patients and analysing contrast sensitivity and other parameters of quality of vision.”

Four phases

Dr Reinstein is participating in a prospective study of hyperopic SMILE at the Tilganga Institute of Ophthalmology, Kathmandu, Nepal. It consists of four phases. The first three phases sequentially enrolled blind eyes, densely amblyopic eyes and mildly amblyopic eyes with aims of establishing the feasibility of the procedure, optimising the laser energy settings and lenticule parameters, and evaluating centration.

The study is now in its fourth phase, which plans to enroll 200 sighted eyes with best-corrected visual acuity (BCVA) of 20/40 or better, sphere ≤+7 D and astigmatism ≤6 D.

The hyperopic SMILE lenticule has a doughnut shape, and in the study is being created with a 6.3- to 6.7-mm optical zone, a 2-mm transition zone, 30-μm minimum thickness and a 90° side cut.

The cap measures 8.8 mm in diameter and is 120 μm thick, and there is a 0.25-mm clearance between the edge of the lenticule and the periphery. A 2-mm incision is made for removing the lenticule, and an escape incision is created on the opposite side.

“The minimum thickness is set at 30 μm because there is no curvature change in the centre of the lenticule, and we wanted to make sure there was no chance of buttonholing through the centre of the doughnut,” Dr Reinstein said. “Surgeons performing myopic SMILE will find that the hyperopic procedure is identical and that the lenticule dissection is no more difficult.”

Outcomes

The efficacy and safety of hyperopic SMILE were analysed in a group of 31 eyes with BCVA of 20/40 or better and compared with outcomes in a cohort of LASIK-treated eyes matched 3:1 for sphere and cylinder (±0.5 D). Mean treated spherical equivalent (SEQ) and cylinder in the SMILE eyes was +5.73 D and 1.15 D, respectively.

The efficacy analysis showed that at 3 months, distance UCVA was the same or better than preoperative BCVA in 47% of SMILE eyes and within one line of preoperative BCVA in 93% of SMILE eyes. In the LASIK-treated eyes, distance
UCVA was the same or better than preoperative BCVA in 50% of eyes and within one line of preoperative BCVA in 81%.

“It is interesting that the vision results are better with SMILE, and we believe this may be explained by the fact that the ocular surface at 3 months is healthier in the SMILE eyes compared with the LASIK eyes,” Dr Reinstein said.
**Safety and predictability**

The safety analysis showed 32% of SMILE eyes lost one line from preoperative BCVA. This finding was expected because of the minification effect of the surgery and similar to the result in the LASIK group where 25% of eyes had a 1-line loss of BCVA, Dr Reinstein said.

The predictability analysis showed that SEQ was within ±0.5 D of attempted in 65% of SMILE eyes and in 53% of LASIK eyes. In the regression analysis, the r² value was higher for SMILE than for LASIK, 0.59 versus 0.48, he noted.

“This is interesting, because we would expect to see tighter correlation in an analysis including more eyes,” Dr Reinstein said. “Therefore, based on this limited comparison, it seems there is less scatter of results with SMILE treatment for higher hyperopia.”

Stability of the SMILE correction was good during the short follow-up. Mean change in SEQ from 1 to 3 months was about 0.1 D in both the SMILE and LASIK groups.


All eyes had BCVA of 20/40 or worse and the mean optical zone for the SMILE group was 6.37 mm. The results showed optical zone centration was similar for SMILE and LASIK. Mean topographic optical zone diameter was significantly larger for SMILE compared with both LASIK groups, and mean induced spherical aberration in the SMILE eyes was similar to the mean change in the 7-mm LASIK group and significantly less than after 6.5-mm LASIK.

“The explanation for the optical zone finding is that with the excimer laser procedure, there are projection errors in the periphery of the cornea that are never fully compensated,” Dr Reinstein said. “SMILE cuts precisely at the location geometrically calculated by the software and gives a truer-sized transition zone. Knowing that transition zone size is key to regression stability and treatment accuracy might also be the explanation for why we saw less scatter in the 3-month predictability outcomes with SMILE.”

**Dr Dan Z. Reinstein, MD**

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This article was adapted from Dr Reinstein’s presentation at the 2017 meeting of the American Society of Cataract and Refractive Surgery. Dr Reinstein is a consultant for Carl Zeiss Meditec.

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**VIDEO**

Dr Robert L. Stamper explains how physicians can help patients by being knowledgeable about available resources.

Go to [OphthalmologyTimes.com/EndStage](http://OphthalmologyTimes.com/EndStage) (Video courtesy of Dr Robert L. Stamper)

**VIDEO**

When implant misalignment is causing significant residual astigmatism, IOL rotation planned using a free online back-calculation tool can be a safe, effective and preferred solution, according to Dr John P. Berdahl.

Go to [astigmatismfix.com](http://astigmatismfix.com) (Video courtesy of Dr John P. Berdahl)

**VIDEO**

Dr Eduardo C. Alfonso discusses what to do about antibiotic resistance with nonresponsive bacterial keratitis.

Go to [OphthalmologyTimes.com/Nonresponsive](http://OphthalmologyTimes.com/Nonresponsive) (Video courtesy of Dr Eduardo C. Alfonso)
Decentration of less than 0.75 mm from a light-constricted pupil with a novel corneal inlay for the surgical correction of presbyopia does not affect visual acuity, task performance, or severity of halos and glare.
cataract & refractive

Eighty-three percent of the implants were centered radially within 0.5 mm of the pupil center, according to Dr Cionni.

Decentration range
There were no significant reductions in distance vision related to inlay decentration monocularly or binocularly within the decentration range found in this study, Dr Cionni noted.

Decentration of the inlay also showed no significant reduction of the improvement in near vision provided by the inlay except for decentrations greater than 0.75 mm, he added.

“A decentration greater than 0.75 mm had a mean monocular uncorrected near visual acuity loss of 1 line,” he said.

This difference was statistically significant. However, only four of the 115 eyes had decentration of more than 0.75 mm.

Visual parallax
One caution that Dr Cionni shared is that when the centre of the pupil is marked using an excimer system and then placed under the slit lamp, the central mark may be shifted. Dr Cionni highlighted a method (see box, above) to account for this parallax.

TWO PRACTICAL CENTRATION LOCATIONS

If the camera capturing the pupil image is coaxial with the patient’s fixation point, the coaxially sighted corneal light reflex (CSCLR) is an approximation of the point on the cornea containing the theoretical concept of a “visual axis.”

(All figures/images courtesy of DR Robert J. Cionni)

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This article was adapted from Dr Cionni’s presentation at the 2017 meeting of the American Society of Cataract and Refractive Surgery. Dr Cionni is a clinical investigator for ReVision Optics.

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NRTIs hold future promise for AMD

Unique mechanism of action blocks inflammasome activation, inhibits toxicities

By Vanessa Caceres, Reviewed by Dr Jayakrishna Ambati

Nucleoside reverse transcriptase inhibitors (NRTIs) or their derivatives could one day be used to prevent or treat age-related macular degeneration (AMD), according to Dr Jayakrishna Ambati.

NRTIs already are used in patients with hepatitis B and human immunodeficiency virus/acquired immune deficiency syndrome, noted Dr Ambati, the DuPont Guerry III Professor of Ophthalmology, vice chairman for research, Department of Ophthalmology, and founding director, Center for Advanced Vision Science, University of Virginia, Charlottesville, Virginia, United States.

Dr Ambati and colleagues have previously researched what causes the degeneration of the retinal pigmented epithelium. A few years ago, they showed how reduction of an enzyme called Dicer leads to the accumulation of Alu repetitive transcripts that are endogenous, leading to cell death.

“In trying to understand these mechanisms, we found that Alu RNAs activate the inflammasome, leading to interleukin-mediated cell death,” Dr Ambati said. “Several other groups have replicated and extended this work.”

Undiscovered MOA

As researchers focused on the development of inflammasome inhibitors, they observed that NRTIs have a previously undiscovered mechanism of action (MOA) that blocks the inflammasome. When this discovery was made, NRTIs had already been used in the clinic for 30 years in other treatments.

“Both NRTIs and modified NRTIs can block inflammasome activation,” Dr Ambati said. “It’s known that NRTIs have a potential cell toxicity because they cause mitochondrial toxicity. Modified derivatives don’t have that toxicity.”

Using animal models, researchers have also found that amyloid-beta deposits can cause retinal pigment epithelial degeneration that is blocked using NRTIs or modified derivatives of NRTIs. In addition, the iron toxicity present in AMD is mediated by inflammasome activation, which NRTIs can prevent.

Dr Ambati and fellow researchers were the first to show that active complement exists in eyes with dry AMD. Now, they have shown complement-induced retinal degeneration can be blocked by NRTIs.

Smoking factor

One last connection with NRTIs is cigarette smoking, a potent epidemiological risk factor for AMD.

“Using cigarette smoke extract administered subretinally in mice, it was shown that this retinal toxicity too can be blocked by NRTIs,” he said.

To help track NRTI use and AMD incidence in humans, Dr Ambati and fellow researchers analysed more than 50 million insurance beneficiaries and focused on patients who had HIV or hepatitis B and who were over the age of 50. None of the patients had a prior diagnosis of AMD.

“We found that NRTI use by some 40,000 patients was associated with an about 50% relative risk reduction in the incidence of new AMD, both dry and wet,” Dr Ambati said.

Work is under way to commercialise the findings about NRTI lammasome, he said.

IN SHORT

Nucleoside reverse transcriptase inhibitors have the potential to prevent or treat AMD.

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No one imaging tool fits all in identifying spectrum of AMD lesions

Consider unique role of different diagnostic modalities, including SD-OCT, FAF, OCTA

By Cheryl Guttman Krader
Reviewed by Dr David Sarraf

Multimodal imaging—including traditional and newer techniques—is necessary for identifying the spectrum of retinal lesions associated with age-related macular degeneration (AMD), according to Dr David Sarraf.

In a review of the application of the different diagnostic modalities that can be used to characterise AMD-related pathologies, Dr Sarraf, clinical professor of ophthalmology, Stein Eye Institute, University of California, Los Angeles, United States, indicated that large drusen (> 125 μm), which are a defining feature of intermediate AMD, are best detected with spectral-domain optical coherence tomography (SD-OCT).

SD-OCT identifies pseudodrusen

SD-OCT is also essential for identifying reticular pseudodrusen, subretinal drusenoid deposits lying above the retinal pigment epithelium (RPE), he noted. Stage 1 reticular pseudodrusen are located underneath the ellipsoid zone and display a ribbon appearance with a hyper-autofluorescent ring, whereas the advanced stage 3 form illustrates a dot appearance and extends across the inner segment ellipsoid band.

Drusenoid pigment epithelial detachments (PEDs) are large drusen (>250 μm in diameter) that exhibit hyperfluorescent staining with fluorescein angiography, but are hypofluorescent with indocyanine green (ICG) angiography. On OCTA these lesions display a dot appearance and may provide opportunity to detect biomarkers of lesion activity.

OCTA is a novel advanced retinal imaging system that can identify the microvascular morphology of type I neovascular lesions and may also provide opportunity to detect biomarkers of lesion activity.

IN SHORT

When it comes to imaging techniques for age-related macular degeneration, there is no one best tool for identifying the diverse array of lesions.
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SD-OCT, drusenoid PEDs display a discrete elevation of the RPE with homogenous hyperreflectivity under the RPE monolayer.

“These lesions have a very high risk for progression to geographic atrophy (GA),” Dr Sarraf said. “The development of choroidal hypertransmission or a serous component within the PED typically heralds the evolution to the GA form.”

**FAF best for RPE atrophy**

Fundus autofluorescence (FAF) is the best imaging modality for tracking RPE atrophy, especially GA in AMD. Pioneering work characterising the different phenotypes of AMD-related GA, defined by fundus FAF patterns, was performed by Dr Frank Holz and colleagues. This group determined the banded form and the diffuse trickling form progress the fastest.

“This is important . . . to consider when counselling patients and designing research trials,” Dr Sarraf said. He added that FAF is informative to identify mimickers of AMD, such as ABCA4 Stargardt’s disease.

Polyps are best diagnosed with ICG angiography, but can also be identified with SD-OCT. Polyps comprise a type I neovascular lesion and may be identified with SD-OCT on the underside of the RPE monolayer of a PED.

A PED is best illustrated with SD-OCT. Serous PEDs appear as well-circumscribed lesions with hyporeflective cavities and may be exudative or vascularised in nature.

“**Fundus autofluorescence (FAF) is the best imaging modality for tracking RPE atrophy, especially GA in AMD**”

**SD-OCT offers more for PEDs**

Chronic fibrovascular PEDs can be identified with SD-OCT as a fusiform complex of highly organised, layered, hyper-reflective bands deep to the RPE, referred to as a multilayered PED.

“Large vascularised PEDs with a height greater than 500 μm may exhibit signs of RPE traction and are at risk of severe vision loss due to RPE tears, especially after anti-VEGF injection,” Dr Sarraf said. “RPE tears are effectively detected with fundus autofluorescence.”

SD-OCT is an essential modality for the identification of type III retinal angiomatous proliferation (RAP) lesions that originate from the deep retinal capillary plexus. This imaging system is optimal to monitor the response of type III NV to anti-VEGF therapy.

OCTA is a novel advanced retinal imaging system that can identify the microvascular morphology of type I neovascular lesions and may also provide opportunity to detect biomarkers of lesion activity, including secondary small vessel branching, peripheral arcades with anastomoses and greater fractal dimension.

“Area and vessel density with OCTA are not significant quantitative biomarkers early, but may provide important metrics with long-term follow up of type I NV,” Dr Sarraf explained. “Other potential biomarkers of activity include secondary branching and peripheral arcade formation, whereas signs of inactivity include the presence of large, dilated straight vessels, absence of secondary branching or peripheral arcades and lower fractal dimension.”

Dr Sarraf added that long-term, serial follow-up of type I NV with OCTA illustrates the inexorable growth in the area and density of these lesions. It also provides both qualitative and quantitative evidence of sustained progression.

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**DR DAVID SARRAF, MD**

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This article was adapted from Dr Sarraf’s presentation at the 2017 Retina World Congress. Dr Sarraf receives research grants from Heidelberg Engineering and receives research grants from and fees as a consultant and speaker from Optovue.
Rapid, precise computer-guided laser treatment using new pattern scanning software (PASCAL PSLT, Topcon) was better tolerated by patients and similar in efficacy and safety for IOP lowering when compared with traditional selective laser trabeculoplasty (SLT). 1

I participated in a randomised controlled trial comparing the tissue-sparing treatment of pattern scanning laser trabeculoplasty (PSLT) with SLT in 58 eyes with primary and secondary open-angle glaucoma (OAG). We found that, over 6 months' duration, PSLT's efficacy was similar to that of SLT. Patients perceived PSLT as more comfortable and the lasers had a comparable safety profile.

Background
The late 1990s saw the introduction of SLT using a Q-switched, frequency-doubled, Nd:YAG laser as an alternative to the previous treatment that employed argon laser. The goal of the 532-nm therapy was to selectively target pigmented trabecular meshwork (TM) cells without damaging the TM architecture or nonpigmented cells.

SLT is repeatable and it has been demonstrated to be effective as primary treatment for OAG as well as an adjunct in early glaucoma treatment.

Computer-guided pattern scanning laser (532-nm yellow) is a new treatment advance, and it has been shown to have several benefits for retinal conditions. Its shorter pulse duration causes less heat to be transferred to the inner retina and choroid, which means less pain for patients, less lateral expansion and reduced damage to the inner retina and choroid. 2

The laser is titrated to a barely visible lesion, and then the pulse energy is reduced by half to produce minimally traumatic treatment on the TM. An algorithm—PSLT—was developed to ensure complete coverage of the TM and proper alignment of the sequence of patterns despite the lack of visible burns. 3

The laser creates arc-shaped patterns that are automatically rotated after each application in such a way that ensures consecutive patterns without overlaps or significant gaps. PSLT delivers energy that is under the threshold necessary to create coagulative damage but within the therapeutic boundary to disrupt the trabecula resulting in the reduction of IOP.

PSLT delivers energy that is under the threshold necessary to create coagulative damage but within the therapeutic boundary to disrupt the trabecula resulting in the reduction of IOP.

Like SLT, PSLT provides uniform coverage of the TM. The important differences in the treatment parameters are, however, that PSLT has longer pulse duration than SLT (5 ms versus 3 ns), a smaller spot size (100 μm versus 400 μm), and slightly higher pulse energy (mJ compared with about 1 mJ generally used in SLT).

A treatment consists of 13 spots in each row; the laser places three rows of spots as close together as possible. This more continuous treatment ensures all parts of the TM are included.

By Dr Kaweh Mansouri

IN SHORT

Pattern scanning laser trabeculoplasty may offer advantages—such as better patient comfort, a more continuous treatment pattern and a faster treatment time—over selective laser trabeculoplasty for treating open-angle glaucoma patients.
Randomised comparative study
We conducted a randomised controlled trial seeking to compare the safety, tolerability and IOP-lowering efficacy of PSLT (PASCAL Streamline 577, Topcon) with SLT (Tango, Ellex) in the fellow eyes of untreated glaucoma patients. Included were 29 patients (58 eyes) with primary and secondary OAG who were randomly assigned to undergo PSLT or SLT in each eye.

We performed PSLT and assessed patients’ comfort level using a visual analogue scale (VAS). The follow-up visits were at week 1 and at 1, 3, and 6 months. In the trial, success was defined as IOP reduction of ≥ 20%.

The patients in our investigation had a mean age of 54.1 years (± 15.5 years), and the baseline IOP was similar between the PSLT and SLT groups (PSLT, 17.3 ± 4.0 mm Hg; SLT, 16.8 ± 3.6 mm Hg, p > 0.05). Stages of glaucoma ranged from early to moderate, with about two-thirds being in the latter group.

Greater IOP lowering
In the PSLT eyes, the mean IOP at 1, 3, and 6 months was found to be 14.2 ± 3.5, 13.9 ± 2.6 and 14.0 ± 2.7 mm Hg, respectively. In the SLT group, the mean IOP at 1, 3, and 6 months was 14.4 ± 4.1, 13.7 ± 3.2 and 13.7 ± 3.1 mm Hg, respectively. The IOP reduction in the PSLT group was greater than in the SLT group at 1 month (p < 0.01) and 3 months (p < 0.01).

The VAS score was better in PSLT eyes (23.9 ± 20.5; range, 0–82) than in SLT eyes (50.4 ± 25.3; range, 0–98; p < 0.001). No serious adverse events were recorded.

It is important to note that most previous studies evaluated the efficacy of laser trabeculoplasty in patients who were also taking IOP-lowering drops. In our study, patients underwent a medication washout and remained untreated for up to 6 months, constituting a strength of this investigation.

In addition, both eyes of patients were included and randomly assigned to the type of laser, eliminating any selection bias.

The better tolerability associated with PSLT compared with SLT was interesting. Although we do not know exactly why this was the case, the shorter duration of treatment is likely a contributing factor: PSLT is up to 50% faster.

Conclusion
PSLT may offer advantages over SLT for treating OAG patients. The new therapy not only offers glaucoma and retina treatments in one laser, it also is associated with better patient comfort, a more continuous treatment pattern and a faster treatment time.

REFERENCES

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Dr Kaweh Mansouri, MPH, is a consultant ophthalmologist at the Glaucoma Center, Montchoisi Clinic, Lausanne, Switzerland, and adjunct associate professor in the Department of Ophthalmology at the University of Colorado School of Medicine in Denver, USA. Dr Mansouri is a consultant to Topcon.

WANT TO SUBMIT AN ARTICLE TO OPHTHALMOLOGY TIMES EUROPE?
The emphasis of every article should be practical and current. Articles describing techniques should include enough information so that readers can make independent judgements about how applicable the approach is for them.

Articles usually contain 1,000 to 2,500 words, plus photos, graphs, charts, tables, diagrams or other appropriate graphics.

The typical time between an initial enquiry and a published magazine article is 1 to 3 months.

Articles must be original work that has not been published elsewhere. Articles are considered for publication with the understanding that they are not simultaneously under consideration for publication elsewhere.

Contact Caroline Richards, Editor, with questions at caroline.richards@ubm.com
IOP reduction in combined glaucoma and cataract surgery

Smallest ab interno gel stent demonstrated safety and efficacy in trial

By Dr Antonio Toso
Dr Simonetta Morselli
Dr Alessandra De Gregorio

Trabeculectomy is the most common glaucoma filtration surgery, although bleb leaks, subconjunctival fibrosis and unpredictable flow account for the majority of surgical failures and pose challenges for the surgeon.

Devices that standardise the flow of aqueous humour (AH) under the subconjunctival space are already in use. However, they still require that a conjunctival incision is placed ab externo and this does not prevent long-term scarring complications.

Minimally invasive (or microincisional) glaucoma surgery (MIGS) has been defined as any glaucoma procedure avoiding conjunctival dissection and thus approached via ab interno incision (clear cornea wound).

An ab interno gelatin stent (XEN Gel Stent, Allergan Inc.) can be implanted via a clear corneal incision without the need for conjunctival incision and is the only available filtering MIGS device that works by subconjunctival filtration, according to its manufacturer.

Three models of the device, varying by lumen size (45, 63 and 140 μm), were initially proposed. The latest implant (XEN 45, Allergan) was designed from principles of fluid dynamics to avoid early postoperative hypotony. The Hagen-Poiseuille equation was used to calculate the required dimensions (6 mm in length, 45-μm lumen size) considering that a longer, thinner tube would provide more resistance to flow than a shorter and wider tube.

In Short

- Implanting the smallest available gelatin stent in primary open-angle glaucoma and cataract surgery patients in a combined procedure resulted in minimal and few side effects.

### TABLE 1 Baseline patient demographic and characteristics (N = 41)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y)</td>
<td>74±7.1</td>
</tr>
<tr>
<td>Range</td>
<td>61-89</td>
</tr>
<tr>
<td>Sex, n (%)</td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>13 (39.4%)</td>
</tr>
<tr>
<td>Women</td>
<td>20 (60.6%)</td>
</tr>
<tr>
<td>Ethnicity, n (%)</td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>33 (100%)</td>
</tr>
<tr>
<td>Medicated IOP (mmHg)</td>
<td>22.5±3.7</td>
</tr>
<tr>
<td>Preoperative medications</td>
<td></td>
</tr>
<tr>
<td>Mean -SD</td>
<td>2.5±0.9</td>
</tr>
<tr>
<td>Pachimetry (μ)</td>
<td>531±5.7</td>
</tr>
<tr>
<td>Glaucoma Type n(%)</td>
<td></td>
</tr>
<tr>
<td>Primary open</td>
<td>35 (85.4%)</td>
</tr>
<tr>
<td>Exfoliation</td>
<td>6 (14.6%)</td>
</tr>
<tr>
<td>Previous glaucoma procedures, n (%)</td>
<td></td>
</tr>
<tr>
<td>Deep sclerectomy</td>
<td>1 (2.4%)</td>
</tr>
</tbody>
</table>

(FIGURE 1) XEN injector: a single-use mechanical delivery system for the XEN Gel Stent (Figure courtesy of Allergan)
This study investigated the efficacy in IOP reduction of the smallest inner diameter lumen gel stent (XEN 45).

**Combined surgery**
In a non-randomised prospective clinical study, forty-one eyes of 33 patients with open-angle glaucoma (OAG) underwent gel stent implantation combined with microincision cataract surgery (see Table 1).

Patients had a complete preoperative clinical examination that included: visual acuity; Goldmann applanation tonometry; slit lamp examination; optical coherence tomography (OCT) analysis (anterior segment, macular and optic nerve); gonioscopy; corneal pachimetry; visual field; and fundus oculi examination.

Postoperative evaluations were performed at 1 day; 1 and 2 weeks; and 1, 2, 3, 4, 6, 9 and 12 months with visual acuity, Goldmann applanation tonometry, slit lamp and posterior pole examination. At 1, 6 and 12 months we additionally performed anterior segment OCT (AS-OCT 3D-1, Topcon Corp.) analysis, gonioscopy and visual field examination.

Treatment outcomes analysed included IOP, medication use, and intra- and postoperative complications. At the end of the follow-up we evaluated the complete success, defined as a postoperative IOP ≥ 6 mm Hg and ≤ 17 mm Hg without glaucoma medications, and the qualified success, defined as a post-operative IOP ≥ 6 mm Hg and ≤ 17 mm Hg with glaucoma medications.

**IOP changes**
The mean preoperative IOP was 22.5 ± 3.7 mm Hg on 2.5 ±
See the sharpest image of retina health.

Modern Retina

Launched and powered by the publishers of Ophthalmology Times, Modern Retina delivers information on technology and clinical practice essential to your community.

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0.9 medication classes. Mean postoperative IOP was 12.5 ± 7.3 mm Hg (p < 0.05) on the first day. Only one patient had hypotony, which occurred at the first postoperative day, with transient peripheral choroidal detachment, which spontaneously resolved within 1 week, without the anterior chamber refilling.

The complete success rate was achieved in 80.4% of patients, while 97.5% experienced a qualified success.

All patients completed 12 months of follow-up, except for one patient who needed a trabeculectomy after 1 month for a stent failure due to a presumable obstruction. After 12 months the mean postoperative IOP was 13.1 ± 2.4 mm Hg (mean IOP reduction of 41.82%) with a mean of 0.4 ± 0.8 medication classes (p < 0.05 for IOP and medications) (see Figure 2). The complete success rate was achieved in 80.4% of patients, while 97.5% experienced a qualified success. No major intra- or postoperative complications were seen during the first year of follow-up (see Table 2).

**Conclusion**

The ab interno placement of the XEN gel stent offers an alternative for lowering IOP with minimum conjunctival tissue disruption.

---

**TABLE 2 Intraoperative and postoperative complications**

<table>
<thead>
<tr>
<th>Intraoperative complications</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subconjunctival bleeding</td>
<td>15</td>
<td>36.5%</td>
</tr>
<tr>
<td>Conjunctival perforation</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Shallow AC</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Flat AC</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Lens contact</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Iris damage</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Conjunctival abrasion</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Vitreo bulge or loss</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Corneal abrasion</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Transient AC bleeding</td>
<td>10</td>
<td>24.3%</td>
</tr>
<tr>
<td>Uncorrect location /repositioning</td>
<td>5</td>
<td>12.19%</td>
</tr>
<tr>
<td>Retrobulbar hemorrhage</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Choroidal effusion/hemorrhage</td>
<td>0</td>
<td>0%</td>
</tr>
</tbody>
</table>
restricted flow to avoid hypotony and long-term safety.

In this small and non-randomised study, we demonstrated the efficacy and safety of the smaller diameter (XEN 45) gel implant, which showed the aforementioned mean IOP reduction, complete and qualified success rates at 12 months with a very low rate of first-year complications. This compares with the largest and medium inner diameter XEN implants results as reported in previous studies.6,7

<table>
<thead>
<tr>
<th>Postoperative complications</th>
<th>Number %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focal reaction to implant</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Bleb related complications</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Requiring additional glaucoma surgery</td>
<td>1(2.4%)</td>
</tr>
<tr>
<td>Corneal abrasion</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Bleb fibrosis requiring needeling</td>
<td>1(2.4%)</td>
</tr>
<tr>
<td>Device explant</td>
<td>1(2.4%)</td>
</tr>
<tr>
<td>Device migration</td>
<td>1(2.4%)</td>
</tr>
<tr>
<td>Device obstruction</td>
<td>1(2.4%)</td>
</tr>
<tr>
<td>Corneal edema</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Transient AC bleeding</td>
<td>10(24.3%)</td>
</tr>
<tr>
<td>Choroidal effusion (&gt;30 gg)</td>
<td>5(12.19%)</td>
</tr>
<tr>
<td>Endophthalmitis</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Erosion</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Flat AC requiring AC refilling</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Hyphema</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Transient hypotonia &lt; 6 mmHg (Day 1)</td>
<td>1(2.4%)</td>
</tr>
<tr>
<td>Persistent hypotonia &gt; 1 M</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Transient choroidal detachment</td>
<td>1(2.4%)</td>
</tr>
<tr>
<td>Iris atrophy</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Iris involvement</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Retinal detachment</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Uveitis</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Subconjunctival Hemorrhage (&gt;30 days post-op)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Wound leak</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>

The ab interno placement of the XEN gel stent offers an alternative for lowering IOP with minimal conjunctival tissue disruption


REFERENCES
Advantages of dry eye disease testing for all pre-surgery patients

Point-of-care tests offer consistent diagnoses, reduce post-operative dry eye

By Dr Francesco Carones

When my colleagues and I decided to expand our range of point-of-care testing and treatment for dry eye, the primary goals were to reduce dry eye discomfort after cataract and refractive surgery and to offer non-surgical patients the relief from dry eye that they have sought for years.

We developed a dry eye centre of excellence, where we routinely screen for dry eye disease according to a standard protocol, and then treat the ocular surface based on individualised plans.

To address both aqueous deficient and evaporative types of the disease, we acquired a range of tests to objectively evaluate the tear film and meibomian glands.

A test intended to measure the osmolarity of human tears (TearLab Osmolarity System, TearLab) tells us the concentration of salts in the tear film. Hyperosmolarity indicates that the film’s aqueous component is reduced, either by evaporation or decreased production, and the patient likely has dry eye.

Another test (TearScope Plus, Keeler) helps us to visualise the tear film, while an infrared camera/meibographer allows us to see and evaluate the meibomian glands.

Because inflammation is part of the dry eye disease process, we use a test (InflammaDry, Quidel) to detect the presence of the inflammatory marker MMP-9. Finally, a tear ferning test shows us whether the tears have a normal or abnormal crystallisation pattern.

These point-of-care tests give concrete, reproducible results that we can share with patients to explain their diagnoses and to monitor the results of treatment over time.

As physicians who have watched the diagnosis of dry eye disease evolve over the years from ambiguous to concrete, objective testing is a welcome addition. From the patient’s perspective, numbers always have a greater, more immediate impact than the subjective opinion of even the most experienced physician.

The power of numbers

In my view, point-of-care testing for dry eye disease has many advantages above and beyond helping us diagnose the problem. One enormous benefit is standardisation.

Tests are consistent, objective and not affected by the differences in perceptions among multiple physicians. A colleague and I may differ in our evaluation of the corneal epithelium or the appearance of the meibomian glands, but our tear osmolarity or MMP-9 test results will be identical.

Concrete numbers and images also help us explain dry eye disease to patients. They can clearly see that their number is not in the normal range for a given test, or see the atrophied meibomian glands we have identified. This evidence is a relief for patients who have suffered with dry eye and received little help.

For asymptomatic patients, objective tests offer proof that they have a problem. This is especially important for patients who are planning laser vision surgery. We explain that surgery reduces tear film production, so it is essential that we take the time to treat dry eye disease before surgery.

IN SHORT

Adding objective point-of-care dry eye diagnostics to your practice has deep, measurable effects, including more accurate and consistent IOL power calculations.
to avoid symptoms later. Based on the evidence, patients are very amenable to treatment.

People like to know that their therapies are driving down their numbers. This makes point-of-care testing a powerful, effective tool to get patients on board.

Another advantage is that dry eye patients love to see their numbers go down. Once we have our baseline tests in our practice, patients begin treatment, possibly including pulsed light therapy (E-Eye, ESW Vision); prescription medications; artificial tears; warm compresses and other measures.

They see the numbers changing because of therapy, which has much more of an impact than simply hearing “I see the tear film is better than last month”. Some of these patients routinely get numbers for their diabetes or glaucoma, so they already have that mindset.

People like to know that their therapies, including the sometimes monotonous or inconvenient steps they take every day at home, are driving down their numbers. This makes point-of-care testing a powerful, effective tool to get patients on board and encourage them to maintain compliance with therapy. And compliance is essential for this chronic, progressive disease where symptoms improve only once the diagnostic numbers are regularised.

Outcomes
When we began using dry eye point-of-care testing preoperatively for all surgical patients, we found that the problem exists in many more patients than we initially presumed. Many patients can have no symptoms, but tests show a tear osmolarity of 320 mOsms/L, a positive MMP-9 test or other positive results for dry eye disease.

As a result of dry eye diagnosis and intervention before surgical measurements, we have seen more accurate and consistent IOL power calculations. We also have been relieved to find that complaints about postoperative dry eye are now rare for all our surgical patients. Patients understand ocular surface disease and reliably fulfill their role in controlling it long term.

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Dr Carones is medical director and cataract and refractive surgeon at Centro Oftalmo-Chirurgico Carones, Milan, Italy.

QUESTIONNAIRES DIFFER IN STRABISMUS QUALITY-OF-LIFE MEASURES
Two questionnaires used to measure quality of life in people with strabismus overlap but differ in important areas, according to researchers. Of the two, only the Adult Strabismus Quality of Life Questionnaire includes functional problems such as avoidance of reading. Go to OphthalmologyTimes.com/Strabismus

GLAUCOMA MONITORING IMPLANT RECEIVES CE MARK
An implantable glaucoma sensor has received CE mark approval for marketing in the European Union. The sensor can provide frequent IOP readings, informing patients and their physicians about how the pressure changes by time of day and from one day to another. Go to OphthalmologyTimes.com/GlaucomaCEMark

VITRECTOMY BEATS SCLERAL BUCKLING IN RHEGMATOGENOUS RETINAL DETACHMENT STUDY
Eyes operated on with pars plana vitrectomy needed fewer reoperations over 180 days than eyes subjected to scleral buckling in a retrospective comparison of patients with rhegmatogenous retinal detachment. Go to OphthalmologyTimes.com/RetinalDetachment
Regenerative cell therapy, tissue engineering are future treatments

While keratoplasty has evolved, researchers are seeking new directions.

By Steve Lenier; Reviewed by Dr Jodhbir S Mehta

There have been major changes in the way keratoplasty has been performed over the past 15 years.

Data from the Singapore Corneal Transplant Study shows there have been improved outcomes in the lamellar surgical techniques compared with the full thickness penetrating keratoplasty (PK). However, different centres and registries have reported differing results.

Data published in 2014 in Ophthalmology showed worse outcomes with lamellar surgery compared with penetrating keratoplasty. It is important to look at registry data, which is from multiple surgeons.

A study, published last year in PLOSOne, compared PK to anterior lamellar keratoplasty (ALK) and endothelial keratoplasty (EK), looking at graft failure outcomes. In all of the multiple studies, there was no statistical significance when looking at failure. This highlights the importance of having good training programmes to try to improve outcomes.

With EK, there are two difficulties with the surgical procedure. One is donor preparation and the other is graft insertion. Upfront, there are good options for outsourcing the donor preparation to eye banks.

How much damage?

The problem with graft insertion is there is no way to know, at the time of surgery, how much damage is being done to the endothelium. That can only be assessed 1 to 3 months postoperatively through specular microscopy, or confocal microscopy once the baseline oedema clears.

Physicians at the Singapore National Eye Center have developed a calcein AM staining system, called CAM, which they use with an adapted Spectralis HRA confocal scanning laser ophthalmoscope (Heidelberg Engineering). This allows the surgeon to immediately look at the amount of damage on the whole graft being prepared for EK surgery. Even as methods improve, this will not solve the worldwide problem with donor retrievals.

A survey of 95% of the world’s transplant data shows that for every one cornea transplanted, there are 70 people needing corneal transplantation, and that out of about 284,000 corneas that are harvested per year, only 185,000 are used. Of those not used, 30% are lost because of positive serology and 60% because of low endothelial cell count.

IN SHORT

Advances in endothelial and anterior lamellar keratoplasty have given it distinct advantages over penetrating keratoplasty, in corneal replacement. However, there are variations in outcomes from different centers. Moving forward, regenerative cell therapy and tissue engineering will be the future treatments of endothelial disease.
The leading indications for endothelial surgery are Fuchs’ dystrophy, bullous keratopathy and corneal regraffing. In the future, regenerative medicine may be the approach for Fuchs’. Bullous keratopathy treatments will include tissue engineering and cell therapy, and tissue engineering will also be used for regraffing.

While in early Fuchs’ the endothelial disease is localised and later becomes more widespread, with bullous keratopathy and regraffing, there is widespread endothelial destruction.

For successful endothelial cell regenerative therapy, the endothelium should be regenerated from cells in the paracentral area of the cornea. By looking at the areas around the central area on specular microscopy you can see what the endothelial cells are like.

If they are healthy here, these cells will repopulate the area where guttata are found. This will determine whether or not a patient is appropriate for this approach.

“Using synthetic guttata we developed, we are able to track human primary endothelial cells as they go into a guttata field, to get an estimate of how much of a problem guttata will cause in a regenerative cell therapy approach,” explained Dr Jodhbir S Mehta, Singapore National Eye Center. “We found that the higher the density of the guttata, the more restriction they have on the speed of the regenerative cells, and the height and shape of the guttata also had an influence.”

“So if you have a high-density guttata field, you should strip this before approaching a regenerative cell therapy concept, [which] will leave you with a primary descemetorhexis,” Dr Mehta added.

“In the literature, there is variability in outcomes of primary descemetorhexis surgery, but the outcomes seem to be slightly better in those younger than 60 year olds,” he said. “We wanted to make this a little bit more predictable, so we took matched pairs of ex vivo corneas, scratched one and peeled the other.”

The Singapore researchers added a ROCK inhibitor to one donor but not the other, to look at the effect of both age and of the inhibitor.

They found that the endothelial cell migration overwhelmingly does better in the presence of a basement membrane, with or without the addition of a ROCK inhibitor.

“The ROCK inhibitor allowed an increase in cellular migration in the older age groups. Thus, it allows this type of regenerative therapy to be undertaken in an older patient.

“So our concept of regenerative therapy for Fuchs’ dystrophy involves stripping away the guttata with high density and transplanting a pure Descemet’s membrane,” Dr Mehta said. “The age of the patient will decide whether you need to use a ROCK inhibitor or not.”

**Tissue engineering**

For tissue engineering, one system, in Japan, is in clinical trials, and the Singapore centre has applied for an IRB clinical trial for their full GMP compliant system.

They take repurposed corneas that would otherwise be thrown away due to low endothelial cells and expand the cell number. The idea is to generate enough cells to expand this at a high cellular density. Using this protocol, which has been published in *Cell Transplantation*, 90 constructs can be made with about a 3,000 cells/mm² density.

The cells then need to be delivered either by anterior chamber injection cell therapy or by putting them onto a carrier.

There are advantages and disadvantages to both systems.

Injection cell therapy is simple and is undergoing human trials. However, there can be inconsistency in the density. The cells can disperse over the anterior chamber and there is some variability in the outcomes reported in the literature.

If a ROCK inhibitor is used, it must be put in at the time, and there is no clinical grade one approved. If the patient has Fuchs’, what is to be done with the guttata? There needs to be a Descemet’s membrane there intact for the cells to stick, so should the guttata be removed or left in place?

When using a construct, the cell density can be better controlled and it is more reproducible in the delivery. However if you use a synthetic carrier, this must undergo GMP approval.

Tissue that is thrown away will be repurposed for tissue engineering.

EK techniques can be improved using the CAM system. The strategy for treating Fuchs’ dystrophy will vary.

For mild-to-moderate cases, it will be a Descemet’s membrane transplant with or without the ROCK inhibitor, depending on age. More severe cases will require an endothelial approach so the guttata can be removed.

For bullous keratotomy, cell injection will work well, though advanced cases might need tissue engineered construct. For regraft cases, cell injection works because there is a basement membrane there for the cells to attach to.
Software update gives OrCam’s artificial eye new capabilities

OrCam Technologies recently launched version 8 of the software that powers artificial vision device OrCam MyEye to mark National Eye Health Week 2017, which took place on 18th-24th September.

The technology enables users to read text, and recognise faces, bank notes and products.

OrCam states that MyEye has been designed to be wearable and easy-to-use by both adults and children who are blind or partially sighted.

The company listed the following three new features that version 8 of the software will provide:

- Enhanced facial recognition – the device can now distinguish between men, women and children (the previous software announced everyone as a ‘person’);
- Colour identification – this added feature provides the user with the colour of the items the device is viewing;
- Automatic page detection – OrCam MyEye can now automatically read a printed page without the need to ‘point’ at the page or press a trigger button. The device now reads ‘hands free’ 3 seconds after the text appears in front of the device.

Bausch + Lomb UK launches new lens

Bausch + Lomb recently announced the launch of the new ‘28 Lens Zenlens Dx Set’, which is designed to meet the growing demand for gas-permeable lenses to correct vision problems associated with corneal irregularities.

Lens diameters of 16mm and 17mm, prolate and oblate designs, and a comprehensive 28-lens diagnostic set will now be available, which the company stated in a press release delivers a “new level of ‘out of the box’ comfort and clarity across a wide range of corneal sizes”.

“To cater for particularly complex corneal issues, Zenlens also features ingenious SmartCurve technology which allows the modification of specific parameters to create a bespoke lens with superb fit and unparalleled wearability,” the firm said.

“What sets the Zenlens apart is the ability to zero-in on the parameter modifications you need to make, and once this adjustment is made, the SmartCurve automatically engages to ensure all other design attributes remain consistent. Toric peripheral curves, customised centre thickness, flexure controlling profiles and front toric Rxs can also be ordered if needed.”

Personalised contact lenses on the agenda with new alliance

The Australian non-profit non-governmental organisation Brien Holden Vision Institute has teamed up with custom-made contact lens manufacturer mark’ennovy to bring to the market a portfolio of soft contact lenses made from silicone hydrogel.

The companies have signed a worldwide exclusive licensing agreement to produce lenses designed to help address the worldwide challenges of myopia control and presbyopia.

Brien Holden will offer its expertise in new lens designs, while mark’ennovy will utilise its experience in producing tandem and precision custom-made disposable contact lenses, with the overall aim being to enable eye care professionals to tailor a monthly disposable contact lens to the unique characteristics of every myopic or presbyopia eye.

Alimera Sciences’ Iluvien to be distributed in France

Alimera Sciences Ltd’s European subsidiary has signed a distribution agreement with the French pharmaceutical company Horus Pharma, to bring Almera’s diabetic macular oedema (DME) drug to the French market.

Under the agreement, Horus will serve as Almera’s exclusive distributor in France for the product, a sustained-release fluocinolone acetonide intravitreal implant indicated in the European Union to treat vision impairment associated with chronic DME considered insufficiently responsive to available therapies.

Horus will negotiate with the Comité Economique des Produits de Santé, the Union Nationale des Caisses d’Assurance Maladie, the French National Authority for Health and other French regulatory authorities regarding the appropriate public price and confidential net price for reimbursement for the drug.

In addition, Horus will handle promotion, marketing and commercial activities in France for the product.
Introducing the next generation EDoF IOL with the widest range of focus.*

ZEISS AT LARA

ZEISS AT LARA – new Extended Depth of Focus IOL
With the widest range of focus* in its category

AT LARA® from ZEISS is designed to provide a high degree of spectacle independence and to induce less visual side effects compared to multifocal IOLs, enabling excellent vision over a wide range of distances – for an active lifestyle.
ZEISS AT LARA allows you to make more patients happy and grow your premium business.

* Compared to J&J TECNIS Symfony and Oculentis LENTIS Comfort IOLs in an unpublished pre-clinical study with 100 subjects. Data on file. ZEISS AT LARA is not available for sale in the U.S.
THE NEXT STEP FOR POWERFUL IOP LOWERING

- Up to 40% vs baseline\(^1\)
- Low level of hyperaemia (7%)\(^2\)
- One drop once daily\(^2\)

**Composition:** One drop contains 0.45 micrograms of tafluprost and 0.15 mg of timolol. One single-dose container (0.3 ml) of eye drops contains 4.5 micrograms of tafluprost and 1.5 mg of timolol. Please refer to the Summary of Product Characteristics (SmPC) for a full list of excipients.

**Characteristics (SmPC):**

**Product Name:** TAPTIQOM\(^\circledR\) 15 micrograms/ml + 5 mg/ml eye drops, solution in single-dose container.

**Indication:** The next step for powerful IOP lowering.

**Dosage and Administration:**

- One drop once daily
- Low level of hyperaemia
- Up to 40% vs baseline

**Warnings and Precautions:** Before initiating treatment, patients should be informed of the possibility of eyelash growth, darkening of the eyelid skin and increased iris pigmentation related to tafluprost. Changes may be permanent, and lead to differences in appearance between the eyes if only one eye is treated.

**Overdose:** Treatment should be symptomatic and supportive.

**Special precautions:** Store in a refrigerator (2°C - 8°C). After opening the pack should not drive or use machines until clear vision returns. Undesirable effects: Conjunctival/ocular hyperaemia occurred in approximately 7% of patients participating in clinical studies with TAPTIQOM\(^\circledR\). Common side effects include: eye pruritus, eye pain, changes in eyelashes, eyelash loss, eyelash thinning and reduction in lashes.

**Interactions with other medicinal products:** Potential for hypotension / marked bradycardia when administered with oral calcium channel blockers, beta-adrenergic blockers, anti-arrhythmics, digitalis glycosides, parasympathomimetics and guanethidine. Please refer to the SmPC.

**Driving and using machines:** If transient blurred vision occurs on instillation, the patient should not drive or use machines until clear vision returns.

**Undesirable effects:** Conjunctival/ocular hyperaemia occurred in approximately 7% of patients participating in clinical studies with TAPTIQOM\(^\circledR\). Other common side effects include: eye pruritus, eye pain, changes in eyelashes (increased length, thickness and number of lashes), eyelash discolouration, eye irritation, foreign body sensation, blurred vision, photophobia. Adverse reactions that have been seen with either of the active substances (tafluprost or timolol) and may potentially occur also with TAPTIQOM\(^\circledR\) include: increased iris pigmentation, anterior chamber cells/flae, iritis/uveitis, deepening of eyelid sulcus, iridocyclitis, anterior uveitis, iritis/uveitis, anterior uveitis, iritis/uveitis, deepening of eyelid sulcus.

**Contraindications:** Hyperaemia (7%)\(^1\)