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\(^\Delta\) compared to IOL Master 700\(^1\), IOL Master 500\(^1\), Lenstar LS900\(^1\). *Compared to VERION™ Reference Unit and VERION™ Vision Planner. ^ Argos biometer has shown better acquisition rates in dense cataract compared to IOL Master 700\(^1\), IOL Master 500 and Lenstar LS900\(^1\). Argos biometer has shown better predictive accuracy in medium-long eyes than IOL Master 500\(^7,8\). Trademarks are the property of their respective owners.

4. ZEISS† IOLMaster† 700 510k Submission 2015.
ESCRS preview
What delegates can expect at this year’s congress in Paris

Perfecting the cataract surgeon signature
Role of phaco incision, capsulorhexis, IOL centration unique

GLAUCOMA

Novel DSLT taking aim at lower IOP
Automated, transscleral, 1-second procedure promising for accessibility

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NEW iMULTI POWER

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NIGHT & DAY

(20 mg/ml dorzolamide + 5 mg/ml timolol eye drops, solution)

Abbreviated Prescribing Information

Product Name: COSOPT®-Preservative-Free 20 mg/ml + 5 mg/ml eye drops, solution, single-dose container. COSOPT®-Multi 20 mg/ml + 5 mg/ml eye drops, solution.

Composition: Each millilitre contains 20 mg dorzolamide (22.26 mg dorzolamide hydrochloride) and 5 mg timolol (6.83 mg timolol maleate). Please refer to the Summary of Product Characteristics (SmPC) for a full list of excipients.

Indication: Treatment of elevated intraocular pressure (IOP) in patients with open-angle glaucoma, or pseudophakic glaucoma when topical beta-blocker monotherapy is not sufficient.

Posology and Method of Administration: One drop of COSOPT in the conjunctival sac of the affected eye(s), two times daily. If another topical ophthalmic agent is being used, administer COSOPT and the other agent at least ten minutes apart. COSOPT is a sterile solution that does not contain preservative. Safety in paediatric patients less than 2 years of age has not been established. Please see the SmPC for use in children of more than 2 years.

Contraindications: Hypersensitivity to any component of this medicine, reactive airways disease, including bronchial asthma, or a history of bronchial asthma, severe chronic obstructive pulmonary disease, sickle cell disease, sickle cell syndrome, syndrome of hereditary angioedema, should be treated with caution. Respiratory reactions, including death due to bronchospasm in patients with asthma have been reported following administration of some ophthalmic beta-blockers. Use with caution in patients with a history of moderate chronic obstructive pulmonary disease (COPD) and only if the potential benefit outweighs the potential risk. Use with caution in patients with heart failure. Concomitant use of dorzolamide and/or oral carbonic anhydrase inhibitors is not recommended. Use of two topical beta-adrenergic blocking agents is not recommended. Caution in patients subject to spontaneous hypoglycaemia or with diabetes. These signs and symptoms of acute hypoglycaemia and hypothyroidism may be masked. Caution in patients with renal disease. The prescriber should be informed when a patient is receiving timolol as beta-blocking ophthalmological preparations may block systemic beta-agent effects e.g. of atenolol. Though no acid-base disturbances have been observed with COSOPT (preserved formulation), patients with a prior history of renal failure may be at increased risk of acidosis. Patients with acute angle-closure glaucoma require therapeutic interventions in addition to ocular hypotensive agents. This medicinal product has not been studied with acute angle-closure glaucoma. Corneal oedema and irreversible corneal decompensation have been reported in patients with pre-existing chronic corneal defects and/or a history of intraocular surgery while using dorzolamide. Precautions should be used when prescribing in these groups of patients. Patients with a history of contact hypersensitivity to silver should not use COSOPT Multi as dispersed drops may contain traces of silver from the container. The medicinal product has not been studied in patients wearing contact lenses. There is limited experience with COSOPT in infants and children. Please refer to the SmPC.

Interactions with Other Medicinal Products: There is a potential for additive effects resulting in hypotension and/or marked bradycardia when ophthalmic beta-blockers solution is administered concomitantly with oral calcium channel blockers, cimetidine, droxorubicin, depleting drugs or beta adrenergic blocking agents, antiarrhythmics (including amiodarone), digitalis glycosides, parasympathomimetics, quinidine, narcotics and monoamine-oxidase (MAO) inhibitors. Potentiated systemic beta-blockade (e.g. decreased heart rate, depression) has been reported during combined treatment with YOPK inhibitors (e.g. quinidine, fluoroxetine, paroxetine) and timolol. Mydriasis resulting from concomitant use of ophthalmic beta-blockers and adrenergic (sympathomimetic) has been reported occasionally.

Pregnancy and Breast Feeding: Do not use in pregnancy or during breast feeding.

Driving and using machines: Possible side effects such as blurred vision may affect some patients’ ability to drive and/or operate machinery.

Undesirable Effects: (Refer to SmPC for complete information on side effects). The side effects observed with COSOPT in one or more components include: headache, depression, burning and stinging, conjunctival injection, blurred vision, corneal oedema, conjunctivitis, tearing, eye irritation, eyelid oedema, signs and symptoms of ocular irritation including blepharitis, keratitis, decreased corneal sensitivity and dry eyes and visual disturbances including photophobia, eye irritation and irritability, dryness, and signs and symptoms of systemic allergic reactions, including angioneurotic urticaria, pruritus, rash, anaphylaxis, arthralgia/myalgia, hypoglycaemia, cardiac arrest, heart block, AV block, cardiac failure, chest pain, palpitation, oedema.

Overdose: Treatment should be symptomatic and supportive. Serum electrolyte levels (particularly potassium) and blood pH levels should be monitored.

Special Precautions for storage: Do not store above 25°C.

Price: COSOPT®-Preservative-Free 60 x 0.2mL single-dose containers £28.69. COSOPT® Multi 1 + 10ml bottle (60 day treatments) £28.00.

MA Holder: Santen Oy, Niittyhaankatu 20, 33720 Tampere, Finland.

MA Numbers: COSOPT®-Preservative-Free PL 16058/0015 COSOPT® Multi PL 16058/0025.

Legal Category: POM.

Date of Prescribing Information: September 2018.

Job Code: NP-CSPTPF-UK-0005

Adverse events should be reported. Reporting forms and information can be found at www.mhra.gov.uk/yellowcard. Adverse events should also be reported to Santen UK Limited (Email: medinfo@santen.co.uk or telephone: 0345 075 4865).
Paris is the scheduled venue for the 37th meeting of the European Society of Cataract and Refractive Surgeons (ESCRS). The congress runs from September 14 to 18 at Pavilion 7, Paris Expo Porte de Versailles, Paris. A highlight for glaucoma specialists is ESCRS Glaucoma Day 2019, which will take place immediately preceding the congress on Friday September 13 in the same location.

In addition to the latest technology available from exhibitors, conference attendees will have the opportunity to hone their clinical and surgical skills by attending clinical research symposia, refractive surgery courses, poster and free paper sessions, and surgical skills courses and wetlabs.

After hours, there is no shortage of attractions and restaurants for attendees to visit and wind down in the most visited of the world’s cities, the City of Light.

Jorge L. Alio, MD, PhD, FEOphth, chairman of ophthalmology, Vissum, Alicante, Spain, and Albert Augustin, MD, professor ophthalmology and chairman, Department of Ophthalmology, Klinikum Karlsruhe, Germany, Ophthalmology Times Europe’s Advisory Board Members, have provided readers with comments on the sessions. See you in Paris!

**Saturday 14th September**

**Clinical Research Symposia**

8:30 am-5:30 pm

The congress opens with a session chaired by Professor Oliver Findl from Austria and Rudy Nuijts from The Netherlands on **Understanding and Dealing with Dysphotopsia**. The topics will cover positive and negative dysphotopsias, ray tracing of negative dysphotopsias, uncovering the origin of negative dysphotopsias with magnetic resonance imaging, neuroadaptation in dysphotopsia, quantifying negative dysphotopsias, and intraocular lens (IOL) designs to avoid negative dysphotopsias.

Chairpersons Damien Gatinel from France and Jesper Hjortdal from Denmark will tackle the topic of **Next-Generation IOLs**, the discussions of which will cover presbyopia-correcting IOLs, multifocal add-on IOLs, material selection for future IOLs, femtosecond laser modification.

**IN SHORT**

Experts discuss highlights of this year’s upcoming ESCRS meeting.
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The next session of the symposium will address Translational Research in Ocular Surgery and will be chaired by Gerd Auffarth from Germany and Beatrice Cochenier from France. The subjects will include new regulatory procedures, corneal stem-cell implantation for ocular surface reconstruction, new galenics and nanotechnology in topical ocular drug deliver, the explosion of biomarkers, hope for gene therapy in ophthalmology, and self-testing by patients.

The final session of the day will be Hitting the Target with IOLs. Chairpersons Guy Kleinmann from Israel and Joaquim Murta from Portugal will steer the course through optimisation of the ocular surface for accurate biometric measurements, when and how to treat low corneal astigmatism, IOL power calculation in regular and unique cases, artificial intelligence and big data in IOL power calculation, intraoperative wavefront aberrometry, and intraoperative optical coherence tomography (OCT) measurements.

Refractive Surgery Didactic Course
8:30 am–5:45 pm
The moderators, David Epstein from Switzerland and C. Roberts from the United States, will run a session that will cover subjects including diagnostic techniques, intraocular surgery and corneal surgery therapeutic techniques.

Young Ophthalmologists Programme
8:30 am–4:00 pm
This programme will help novice ophthalmologists learn the procedures involved in phacoemulsification. The programme highlights are videos submitted by young ophthalmologists, referred to as ‘learning from the learners’. Oliver Findl from Austria, Simonetta Morselli from Italy, F. Ribero from Portugal and Kaarina Vannas from Finland will steer the attendees through the learning process with topics that range from preparing the first operation,ometry, incisions, and capsulorhexis and hydrodissection, among others.

Main Symposia: ESCRs/ EuCornea Symposium: Cataract Surgery in Eyes with Diseased Corneas
2:00 pm–6:00 pm
The Main Symposia span the entire length of the conference. On Saturday, the first segment will be chaired by Massimo Busin from Italy and Jesper Hjortdal from Denmark. The topics that will be presented will include a range of complicated scenarios that surgeons may encounter in eyes with corneal disease, including:

1. performing cataract surgery with an opaque cornea: overcoming poor visualisation
2. opting for cataract extraction alone despite endothelial pathology
3. DALK with cataract surgery: a sensible approach?
4. DSAEK or DMEK: which to combine with cataract surgery in the diseased cornea?
5. when PK is preferable to endothelial keratoplasty
6. IOL calculations in the pathological cornea.

“This year’s clinical research symposia on IOLs will deal with an important issue. At this time, the new generations of IOLs, which are appearing for the future, are basically targeting the limitations that have been achieved or reached with the previous technology now in use. Some of the most important are the side effects of dysphotopsia and other photic phenomena, which will be corrected by innovative designs and new materials. Most of these new lenses will be the products of the translational research that is being conducted both in IOL manufacturing and design and also in the surgical use, and especially in patient selection and preparation. IOL power calculation is included in these topics and, indeed, new biometric tools, new formulas based on big data and artificial intelligence and, most probably, new diagnostic criteria that will integrate many diagnostic tools and final surgical recommendations will become available very soon,” Dr Alio commented.

He continued: “Regarding the topic—Cataract Surgery in Eyes with Diseased Corneas—many patients now are approaching the age at which cataract surgery will be required after having undergone a corneal refractive surgery. These patients are targeted by surgeons in the presence of many limitations, the main one being the IOL power calculation and the second the influence on the quality of vision that will result due to the optical quality of the cornea and also the problems of the corneal transparency. Such limitations limit the indication of premium IOLs. Patient selection, IOL power calculation and IOL selection are the key factors to success.

“However, cataracts can occur as well in corneas in which the quality of the light transmission is affected, such as following trauma, keratitis and also corneal dystrophies that are to be operated on with or without the need for a corneal graft. Performing a simultaneous corneal graft and cataract surgery and dealing with a cataract surgery without removing the borderline transparent cornea are indeed subjects of the utmost importance for the advanced cataract surgeon.”

Dr Augustin also underscored the importance of attendance at this Main Symposium. “It is highly recommended to attend this session, which is chaired by one of the major experts in the field. The audience will be provided with the newest
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GOAP 2018 awardees were presented with their Research Award or Fellowship Award trophies at the Asia and EU editions of the prestigious Controversies in Ophthalmology (COPHy) congress

This event gave awardees the opportunity to:

- Present their research at a dedicated poster session
- Network with peers within the ophthalmic community
- Attend presentations given by world-renowned experts in ophthalmology as part of the COPHy congress

To find out more about the program visit the website:
www.bayer-ophthalmology-awards.co.uk (for UK applicants only)
www.bayer-ophthalmology-awards.com (for non-UK applicants)
information from both research and clinical practice,” he pointed out.

**Sunday 15th September**

**Binkhorst Medal Lecture**
10:00 am–10:55 am
Ehud Assia from Israel will deliver this prestigious lecture entitled *Thinking Outside the Box* during the opening ceremony. He is full professor at Tel-Aviv University, and his main interests are lens pathophysiology, anterior segment surgery and intraocular implants.

**Main Symposia: Surgeons Under Stress**
11:00 am–1:00 pm
The second leg of the Main Symposia will be chaired by Oliver Findl from Austria and Marianne Severinsen from Denmark. Experts will provide their pearls for dealing with stress, the running out rhexis, constricting pupils, the wobbling lens and the challenging phakic IOL. Other topics include ‘surgical stress quantified’, ‘the SMEK flap upside-down’ and ‘relaxing the patient’ (followed by ‘relaxing the surgeon’).

While complications are a fact of life, surgeons must be ready for them, and this symposium helps with that, according to our resident experts.

Dr Augustin states: “Nobody likes to talk about complications. However, they do occur under the best of circumstances. This symposium will teach you how to avoid and to manage those complications”.

“Special cases call for special surgeons,” Dr Alio said, “but sometimes a novice or inexperienced surgeon faces problems during surgery, which creates stress. The manner in which surgeons deal with these situations is a matter of professionalism. Surgeons’ training, operative control, including anaesthesia, availability of the appropriate technologies and surgical tools in the operating room to solve the problems, when unexpected, and adequate technical and human resource assistance, are essential. Planning the solution to a problem relieves the stress and favours a good outcome”.

**Practice Management Masterclass**
08:30 am–6:00 pm
This workshop, entitled *A ‘Patient Experience’ Summit: Building A Patient-Centric Ophthalmic Practice That Maximises Profits*, will be conducted by A. Carones from Italy and M. Malley from the United States. The experts will challenge attending surgeons to critically assess their effectiveness in various aspects of their clinics, including physician time management, practice profit margins, patient education processes, premium services planning, staff conversion training, practice culture commitment, exit-strategy evaluation, staff incentive strategies, maximising surgeon production, and cost control.

**Young Ophthalmologists Session**
4:00 pm–6:00 pm
This session, *Cataract Surgery: Learning from Our Mistakes (video-based didactic lectures)*, will help young ophthalmologists to move from novice to intermediate to advanced surgeons with the aid of video-based lectures. Subjects for the novice surgeon will include the novice getting the crack and avoiding posterior capsule tears; for the intermediate surgeon, approaching PEX patients and handling IFIS and small pupils; and for the more advanced surgeon, performing the first anterior vitrectomy and deciding which IOL to use.

**Video Awards Session**
4:00 pm–6:00 pm
The winners of the 2019 Video Competition will be announced during this session.

**Monday 16th September**

**ESCRS Practice Management and Development Programme**
08.00 am–6:00 pm
This course, which is entitled *Challenges and Opportunities for the 21st-Century Practice*, will give attendees the opportunity to listen to the Report on ESCRs Practice Management and Development Activities 2019 and learn about next-generation marketing, diversification as the key to digital success, and lessons learned from GDPR. The audience will also be able to talk with the experts, learn how to build a high-performing practice by investing in staff and patients, optimise patient flow in a busy practice, and negotiate.

**ESCRS Heritage Lecture 2019**
10:30 am–11:00 am
David Spalton from the UK will deliver this prestigious lecture entitled *Relieving the Stress and Favouring a Good Outcome*.
Tuesday 17th September
Main Symposia: The Unhappy Pseudophakic Patient
11:00 am–1:00 pm
This session’s topics include: causes of patient dissatisfaction in the Swedish Cataract Registry, 20/20 but still unhappy, happy until the IOL dislocated, negative dysphotopsias, unhappy toric IOL patient, and unhappy multifocal IOL patient. The section will be managed by Anders Behndig from Sweden and Rudy Nuijts from The Netherlands.

“Every practice has unhappy patients. This session will teach you how to determine the reason for their unhappiness and, importantly, how to manage those patients. I strongly recommend that ophthalmologists attend a session such as this one at least once a year,” Dr Augustin stated.

Wednesday 18th September
Main Symposia: Long-Term Implications of Standard Refractive Procedures
11:00 am–1:00 pm
The final session will include the discussion of the following topics: laser-assisted in situ keratomileusis, photorefractive keratectomy, corneal ring segments, corneal inlays, phakic IOLs, and refractive lens exchange. The chairpersons will be Jose Guell from Spain and Francois Malecaze from France.

“Refractive surgery of the cornea has reached maturity following more than 25 years of enormous development. Some of these techniques fail in the long term while others have been confirmed in their successful outcomes. The different techniques and the perspective provided by the test of time will be of most interest for cataract and refractive surgeons who want to see not only the history but also the perspectives of the practice of today’s refractive surgery in the future,” according to Dr Alio.
Best of the Best Review Session
9:00 am-9:30 am
This is a wrap-up of the of the most interesting presentations and videos presented during the conference as determined by a panel of physicians.

Throughout the conference
Certain elements of the congress programme are available each day at different times. These include the following:

Surgical Skills Training Courses and Wetlabs
The cost for all wetlabs for trainees is fixed at €100 per course. For regular delegates, the costs will vary between €100 and €150, depending on the amount of equipment and preparation required for a particular wetlab.

Surgical skills training courses are hands-on wetlab courses utilising high-communication wetlab technology as well as the SFVT eye model with red reflex and changeable intraocular pressures. These classes offer participants the opportunity to practice surgical techniques on porcine eyes. The classes are small and utilise two-way audio and video as teaching tools.

Attendance in surgical skills training courses is limited and pre-booking for the courses is advised.

Dr Alio explained the importance of these courses: “Surgical wetlabs are natural complements to meetings for improving the skills in particular surgical techniques. Wetlabs are traditionally conducted at ESCRS with success and professionalism. Junior doctors and those who attend with the intentions of learning a new surgical technique and using new surgical tools are invited to attend these courses”.

Instructional Courses
Always a high point of ESCRS, instructional courses are available throughout each meeting day. The starting times vary, with the courses running from 8:30 am to 6:00 pm on Saturday, from 8:00 am to 6:00 pm on Sunday, from 8:00 am to 6:00 pm on Monday, and from 8:30 am to 4:00 pm on Tuesday.

Free Paper Sessions
Free paper sessions are scheduled throughout the programme, beginning on Saturday and continuing on Sunday, Monday and Tuesday.

Poster Sessions
Poster sessions, both presented and moderated, will be conducted in Poster Village. They are scheduled to run on Saturday from 2:00 pm to 4:30 pm, on Sunday from 9:00 am to 4:30 pm, on Monday from 9:30 am to 4:00 pm, and on Tuesday from 9:30 am to 5:00 pm.

Poster Hall
The exhibit hall will be open each day beginning on Saturday from 9:00 am to 5:00 pm. The exhibits will be located in the same venue as the conference.
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There is no longer any reason to dread cataract surgery in eyes with uveitic glaucoma, according to Mark A. Werner, MD, Delray Eye Associates, Delray Beach, FL, USA. Although there was a time when performing cataract surgery in these patients was a frightening prospect, the prognosis has improved, Dr Werner said.

“They can do quite well,” he said. Dr Werner points to more and better options for steroid delivery and systemic immunosuppression, as well as better knowledge of the importance of aggressively managing inflammation in these patients. In addition to those factors, modern surgical techniques are less traumatic to the eye, he added.

“If patients have poor outcomes now, it is more likely due to posterior segment complications of the underlying uveitis,” Dr Werner said.

There is no longer any reason to dread cataract surgery in eyes with uveitic glaucoma, according to Mark A. Werner, MD, Delray Eye Associates, Delray Beach, FL, USA. Although there was a time when performing cataract surgery in these patients was a frightening prospect, the prognosis has improved, Dr Werner said.

“They can do quite well,” he said. Dr Werner points to more and better options for steroid delivery and systemic immunosuppression, as well as better knowledge of the importance of aggressively managing inflammation in these patients. In addition to those factors, modern surgical techniques are less traumatic to the eye, he added.

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Physicians also can focus on treating inflammation and IOP in patients

Problems arise

Potential problems in uveitic glaucoma patients often are linked to their specific disease. For example, a patient with pars planitis is more likely to have cystoid macular edema. A patient with Behçet’s disease may have even more significant posterior segment disease that could limit the visual prognosis.

“It is important to counsel patients on that,” Dr Werner said.

In patients with juvenile idiopathic arthritis, surgeons can improve outcomes with aggressive suppression of inflammation. Glaucoma and hypotony are both concerns, Dr Werner added.

Anecdotally, Dr Werner said he has noticed that patients with rheumatoid arthritis may have decreased encapsulation of glaucoma drainage implants.

IN SHORT

- Patients with uveitic glaucoma have diverse presentations. Carefully planned cataract surgery can be successful in the uveitic eye.

Dr Werner shared several other pearls to prepare for and perform cataract surgery in a uveitic eye:

- Decide on a perioperative treatment plan in advance.
- If you plan to use immunosuppressants, consider consulting first with a rheumatologist or uveitis specialist.
- Know in advance the patient’s history of steroid responsiveness, the state of their optic nerve, and how good their pressure control is.
- Make sure to perform a thorough cortical cleanup during surgery.
- Acrylic monofocal implants may be associated with improved outcomes in this patient group.
- Consider using a femtosecond laser if it is an option. “I do not use it personally, but there are some reports in standard cataract surgery that there may be less inflammation generated,” Dr Werner said.
- Know your options for steroid depot injections and how long they will last. If a patient has posterior pathology, a steroid injection in the back of the eye may be warranted. However, consult with a retinal specialist, and consider the potential for a steroid response.
- Think about the use of a flow-restrictive tube at the time of surgery to help control pressure.
Postoperatively, focus on the control of inflammation first, and treat IOP secondarily.

“I would advocate for the use of a nonabsorbable suture and to secure your plate well if you are doing a tube shunt,” he said.

**Watch inflammation**

Surgeons should also consider how long a patient has gone without inflammation.

Dr Werner said a patient should experience 3 months with no inflammation before a good outcome is backed by evidence. “In Behçets disease, 6 months may even be better,” he said.

It also is preferable that the systemic disease is quiet.

Postoperatively, focus on the control of inflammation first, and treat IOP secondarily.

“For anterior intraocular lens opacity or membranes, you can use a YAG laser beam, turn off the retrofocus, avoid the central lens and the iris, and turn the laser energy down, once the eye is quiet,” Dr Werner said.

Dr Werner shared information on a patient that he treated with rheumatoid arthritis that was reasonably controlled with low-potency steroids. The patient had visually significantly cataracts, posterior synechiae, and IOP that was not well controlled.

When evaluating the patient’s optic nerve, Dr Werner saw that she had pre-perimetric glaucoma.

He performed cataract surgery along with Ahmed tube insertion, a 7-0 Vicryl suture ligation and an orphan trabeculectomy. Triamcinolone (20 mg sub-Tenon’s) also was used. She has done quite well with 4 years of follow-up, he said.

**DR MARK A. WERNER, MD**
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This article was adapted from Dr Werner’s presentation at the American Glaucoma Society annual meeting. Dr Werner is a speaker for Bausch + Lomb.

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Follow us!
Making a mark: What is your cataract surgery signature?

Surgeons leave a unique signature: master yours for optimum results

By Dr Uday Devgan

Many ophthalmologists will perform tens of thousands of cataract surgeries during their careers and each of these procedures can improve the vision, and the enjoyment of life, for a patient. We take pride in our work and we want to deliver the best for our patients. We also leave our unique signature on every eye on which we operate.

One year or even one decade after a cataract surgery, anyone who examines the patient with a slit-lamp microscope will notice these three things—the signature of the surgery:

1. the capsulorhexis,
2. the incisions, and
3. the position of the IOL.

Take time to master each of these steps to produce the best visual results for the patients and also to perfect your surgical signature. Everything else in the surgery, including the nucleo-fractis technique, the ultrasound energy, the fluidic volume used, the viscoelastics, and even the postoperative inflammation, is transient and will not be seen years later.

**The capsulorhexis**

To optimise the first part of your signature, measure the capsulorhexis to ensure the correct size and placement.

The capsulorhexis is important for successful cataract surgery because it gives the capsular opening strength during cataract removal and allows for stable, long-term positioning of the IOL.

We can create the capsulorhexis using forceps or a bent-needle (cystotome) and we aim to make it round, well-centred, and about 5.0–5.5 mm in diameter for most cases. For these manual techniques, it is helpful to measure first to get an idea of the appropriate size prior to starting the capsulorhexis.

We can also use automated devices such as a femtosecond laser or units which uses a electrical

---

**IN SHORT**

- Phaco incision, capsulorhexis and IOL centration make up the ‘signature’ of cataract surgery.

**FIGURE 1**

(A) We use the forceps to estimate the ideal position and size of the capsulorhexis, then, during this step, we can use the marks on the forceps tips (B) to ensure the correct radius and diameter of our opening. Videos are available at https://cataractcoach.com. (Images courtesy of Dr Devgan)
discharge, to create a consistent capsulotomy.

Most of the time, I use forceps, which have been marked at 2.5 mm and 5.0 mm from the tip, to guide me. At the beginning, prior to starting the capsulorhexis, I measure the anticipated position and diameter. Then I start the tearing of the anterior lens capsule and then stop and re-measure just to be sure. Then, after completion of the capsulorhexis, a final measurement is done to confirm the correct diameter (Figure 1).

Many surgeons use the iris or pupil size as a guide for capsulorhexis creation—but you should not. Do not fall into this trap. Look at the picture in Figure 2: both eyes have the same model lens with a diameter of 6.0 mm and both have a capsulorhexis which is about 5 mm in diameter, giving and excellent overlap of the optic. But the eyes are very different—the anterior segment size, the white-to-white measurement, and the pupil dilation are all markedly different. In the large myopic eye, using the iris as a guide would have resulted in an overly large capsulorhexis which would not have held the IOL optic securely. This is the reason why I use marks on my forceps.

The incisions

For part 2, craft the phaco incision so that it has a balanced architecture—it will seal better and induce less astigmatism.

The phaco incision is critical to the success of the cataract surgery.

It gives us controlled access to the cataract, assists in maintaining fluidic balance, induces minimal astigmatic changes, and seals securely. A well-constructed incision makes the surgery safer and the recovery quicker.

A good incision will have excellent balance between the roof and the floor and an appropriate architecture. It will seal well and securely with minimal astigmatic effect.

If the incision has too long of a tunnel length, it starts out very shallow with a thin roof and then the surgeon abruptly changes angle to enter the anterior chamber. The result is a bad incision with too thin of a roof and too thick of a floor which

‘Take time to master each of these steps to produce the best visual results for the patients and also to perfect your surgical signature.’

— Dr Uday Devgan

‘The phaco incision is critical to the success of the cataract surgery.’

— Dr Uday Devgan
The angle of approach of the keratome will determine the tunnel length of our phaco incision. If the angle is very flat and the blade is right against the ocular surface, the tunnel length will be long. If the angle is greater and the blade is now more parallel to the iris plane, the tunnel length will be shorter. We can vary this angle as we make the incision to tailor the technique to the anatomy so that every eye has a great incision. This angle tends to be about 30 degrees (Figure 4) but it can vary based on the patient’s anatomy. The corneal curvature plays a role as does the corneal thickness. There are variations in human anatomy so the surgeon must be able to make adjustments to provide the ideal result for each individual eye.

If your incisions tend to be too short, then using a smaller angle with the tip of the keratome angled more toward the corneal apex is appropriate. If your incisions tend to be too long, then using a larger angle will allow the tip of the keratome to enter the anterior chamber sooner, resulting in a shorter tunnel length.

**The position of the IOL**
The final part of your signature involves centring the IOL, particularly if there is an optic with diffractive rings, and dial in the correct toric axis.

With new technology IOLs, we have the ability to address corneal astigmatism as well as provide a wide range of vision without glasses. The toric correction on the IOL must be aligned with the steep corneal axis and the diffractive rings of the multi-focal, tri-focal, or extended-depth-of-field optic must be centred appropriately.

The technique that I prefer is to first align the toric marks of the IOL with the steep axis of the cornea, and then centre the diffractive rings using the Purkinje images (Figure 5). This ensures the best visual outcomes for the patient.

We enjoy performing cataract surgery as much as our patients enjoy the visual results, and we take pride in every case that we do. Think of the phaco incision, capsulorhexis, and IOL centration as your “signature” on every cataract surgery that you perform. These are the three most obvious signs of the prior cataract surgery and they are a reflection of the surgeon’s meticulous attention to detail. We want to strive to make a beautiful incision with balanced architecture and a round and appropriately-sized capsulorhexis. Then, the well-centred IOL will perform at its best and produce the best vision for our patients.

Dr Uday Devgan, MD, FACS
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Dr Devgan is in private practice at Devgan Eye Surgery in Los Angeles and Beverly Hills, USA. He is clinical professor of ophthalmology at the Jules Stein Eye Institute at the UCLA School of Medicine and Chief of Ophthalmology at Olive View-UCLA Medical Center. Dr Devgan owns and runs CataractCoach.com, a free teaching website where a new article/video is posted every day.
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A n investigational IOP-lowering modality—direct selective laser trabeculoplasty (DSLT) (BELKIN Laser)—is being developed for its potential as a first-line treatment for ocular hypertension (OHT) open-angle glaucoma (OAG) and possibly for angle-closure glaucoma (ACG) that overcomes the limitations of current initial therapeutic options.

The non-invasive, non-contact procedure is performed with automated laser technology that delivers 100 spots to the trabecular meshwork through the limbus in just 1.2 seconds.

A proof-of-concept study provided evidence for the efficacy and safety of the transscleral approach to laser beam delivery using a conventional SLT instrument, and studies are under way outside of the United States using the external automatic glaucoma laser device itself.

The aim is to provide a solution for addressing the growing worldwide burden of glaucoma-related vision loss, said Michael Belkin, MD, MA, inventor of DSLT and founder/medical director of BELKIN Laser, Yavne, Israel.

“Poor patient compliance and accessibility to medications limits success with medical management of glaucoma,” said Dr Belkin, who is also professor of ophthalmology and director, Ophthalmic Technologies Laboratory, Goldschleger Eye Research Institute, Tel Aviv University Sheba Medical Center, Tel Hashomer, Israel.

Many studies have established that SLT is an appropriate first-line option for IOP-lowering, and most recently, results from the Laser in Glaucoma and ocular Hyper/tension (LiGHT) trial showed that SLT was more cost-effective than medication when used in treatment-naive patients [Lancet. 2019;393:1505-1516], according to Dr Belkin.

“SLT, however, is generally performed only by glaucoma specialists because it requires expertise with gonioscopy,” he added.

“The reality, however, is that even in areas in developed countries, there are not enough glaucoma specialists to meet the need for services, and the disparity between demand and supply is far worse in developing nations around the world,” he said.

DSLT can make laser treatment for IOP-lowering broadly accessible to patients around the world because it is performed without need for a goniolens or slit-lamp delivery system, according to Dr Belkin.

“Over the past years, innovations to treat glaucoma typically focused on invasive therapies, rather than first-line solutions,” said Daria Lemann-Blumenthal, LLB, EMBA, chief executive officer of BELKIN Laser.

“Our purpose . . . is to increase accessibility to glaucoma care by offering a very simple, automated, 1-second laser treatment that can be performed as an initial treatment by all ophthalmologists at any location,” she added. “Our professional team and key opinion leaders are committed to bring this sophisticated technology to the market and support its safety and efficacy through well-designed clinical studies.”

‘Poor patient compliance and accessibility to medications limits success with medical management of glaucoma.’  – Dr Michael Belkin

Light trial
Sir Peng Khaw, MD, PhD, professor of glaucoma and ocular healing, University College London and Moorfields Eye Hospital, London, UK, described DSLT as exciting technology because of its convenience and ease of use.

Considering the results of the LiGHT trial and the promise that DSLT has shown in early investigation, DSLT seems poised to create a significant paradigm shift in the treatment of OHT.

IN SHORT

Direct selective laser trabeculoplasty is an automated, transscleral, 1-second procedure that holds promise for increasing accessibility to IOP-lowering treatment. Clinical trials are under way.
traditional SLT,” he said. Personnel needed to perform instrumentation and sophisticated procedures in areas lacking the ancillary support of nurses and anesthesiologists might be considered poor candidates for prospective studies. The technique may be feasible for patients who otherwise would not be candidates, said Dr Khaw.

“Lowering treatment,” said Dr Lindstrom, adjunct professor emeritus, Department of Ophthalmology, University of Minnesota, Minneapolis. “Based on its efficacy and safety, SLT is widely accepted as an appropriate alternative to medications as a first-line IOP-lowering treatment,” said Dr Lindstrom, adjunct professor emeritus, Department of Ophthalmology, University of Minnesota, Minneapolis.

“DSLT brings the opportunity to expand the use of SLT by making it feasible for patients who otherwise might be considered poor candidates because they are uncooperative and in areas lacking the ancillary instrumentation and sophisticated personnel needed to perform traditional SLT,” he said.

His original vision was to create a system that could automatically deliver all 100 laser spots simultaneously. Ultimately, he had a system designed that delivers the 100 spots at the limbus in rapid sequence.

Spot delivery is achieved using a scanner and the investigational DSLT device also incorporates an advanced image-processing algorithm that accounts for eye movement and locates the exact treatment area.

**Gathering the evidence**

Dr Belkin collaborated with Noa Geffen, MD, and colleagues at Meir Medical Center, Kfar-Saba, Israel, to undertake a proof-of-concept study to demonstrate that if application of the laser spots through the sclera lowered IOP as effectively as standard SLT [J Glaucoma. 2017;26:201-207].

The randomised study included two groups of 14 patients each. The control group was treated with traditional SLT and the study group was treated with the same SLT protocol but with transscleral delivery. The delivery area of 100 laser spots to the trabecular meshwork through the limbus was treated with the same SLT protocol but with transscleral delivery.

Six months showed no statistically significant differences between the two treatment arms in mean IOP reductions or success rates whether ≥15% reduction from baseline IOP or ≥20% decrease. The overall rate of procedure-related adverse events was <5% and mostly minor. The study showed that both anterior chamber inflammation and superficial punctate keratitis were significantly less common in the study group compared with the controls, and the difference between treatment groups in the rate of ocular discomfort was also favored the transscleral group nearly achieved statistical significance.

“The goniolens and its rotation on the cornea can produce corneal lesions and patient discomfort, and it also obviates the need for the goniolens contact gel,” Dr Belkin said. “These issues are avoided with non-contact DSLT.”

**Preclinical research**

Initial preclinical studies conducted with a prototype of the DSLT device provided evidence of its safety. DSLT is currently being investigated in a multinational, prospective, randomised, controlled study comparing it with standard SLT.

Funded by a €2.5 million grant from EU Horizon 2020, the study is under way at Universita degli Studi di Genova, Genova, Italy. Patient enrolment began last year.
More information

BELKIN is an acronym for Biostimulative External Laser Keratoscleral IOP Normalizer. The company is a graduate of the incubator program at the Israel Innovation Authority and won the first prize in several competitions, including the China-Israel Innovation Contest 2018 and the Israeli Academia start-up competition 2016.

recruitment will be starting soon at Queens University Belfast, Moorfield Hospital, London, and Beilinson Medical Center, Tel Aviv, Israel.

The study is including patients age 18 years or older who have an average IOP of at least 22 mm Hg measured at two pre-treatment visits in the eye that will be treated. It is enrolling 15 patients.

Initial patients were treated with an energy of 0.8 mJ dose, the same as that used for conventional SLT, and the energy is being escalated.

“Some of the laser beam is absorbed in the sclera and some of it is also scattered,” Dr Belkin explained. “While scatter is desirable because it means more trabecular meshwork cells will be impacted, there is still a threshold level that needs to be achieved for the desired activity.”

So far, data are available from three patients who completed 6 months of follow-up.

Results in this small group show that IOP was reduced by an average of about 25%, which is comparable to the benefit associated with conventional SLT, Dr Belkin said.

Safety has been favorable. In the second patient enrolled in the study, the treatment missed its mark, being delivered to the conjunctiva away from the limbus, and the patient developed a small hemorrhage that resolved within a few days.

“A modification of the system has solved the potential for that occurrence,” Dr Belkin said.

“While there would be no such restriction for patient selection when performing DSLT,” Dr Belkin explained.

“Angle-closure glaucoma accounts for about 30% of glaucoma cases worldwide and for the majority of irreversible blindness in Asia, and there is a major unmet need for better treatments for this common disease.”

– Dr Michael Belkin

Eligible patients are age 40 years or older and have visual acuity >6/60 in both eyes, OAG including exfoliative or pigmentary glaucoma, IOP ≥22 mm Hg to ≤35 mm Hg (after washout of any IOP-lowering medications), a gonioscopically visible scleral spur for 360° without indentation, and a visible perilimbal sclera for 360° with use of a lid speculum.

The study has a non-inferiority design and is comparing the difference between the SLT and DSLT treatment groups between the mean baseline IOP and the mean IOP at 6 months after treatment as its primary outcome measure.

A single-center, dose-response study under way at Goldschleger Eye Institute, Sheba Medical Center, Ramat-Gan, Israel, is a 6-month trial enrolling patients with uncontrolled OAG who will undergo DSLT in one eye.

‘Angle-closure glaucoma accounts for about 30% of glaucoma cases worldwide and for the majority of irreversible blindness in Asia, and there is a major unmet need for better treatments for this common disease.’

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“A modification of the system has solved the potential for that occurrence,” Dr Belkin said.

“The only other side effect has been transient blurred vision that occurred after the procedure in the first three patients,” he said. “We think the bluriness may be related to the brightness of our illumination LEDs and has not occurred since an adjustment was made.”

Dr Belkin noted that DSLT is performed under topical anesthesia, and added that none of the 12 patients treated so far in the dose-response study felt any pain.

Expanding the indication

Planning is also under way to conduct studies of DSLT in China, including as a treatment for angle-closure glaucoma.

Because the treatment is delivered through the sclera and does not require visualisation of the angle, DSLT may be a viable treatment for primary angle-closure or primary angle-closure glaucoma, according to Dr Belkin.

“Results of a study done in Singapore showed that eyes with primary angle-closure or primary angle-closure glaucoma respond well to SLT [JAMA Ophthalmol. 2015;133:206-212].”

Because of the need to visualise the angle with a gonioscopy lens, however, patients were only eligible for SLT if the angle was opened at least 180°.

“There would be no such restriction for patient selection when performing DSLT,” Dr Belkin explained.

“Angle-closure glaucoma accounts for about 30% of glaucoma cases worldwide and for the majority of irreversible blindness in Asia, and there is a major unmet need for better treatments for this common disease,” he said.
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Technology assisting surgeons in capturing spectral-domain OCT

Common devices differ in hardware, analysis and display of data

Spectral-domain optical coherence tomography (SD-OCT) technology has been progressively advancing in recent years. In the United States, some commonly used instruments are currently manufactured by Optovue, Inc., Heidelberg Engineering and Carl Zeiss Meditec.

While these are common devices, the features among them differ, according to Angelo P. Tanna, MD, vice chairman and associate professor of ophthalmology and director of the Glaucoma Service, Northwestern University Feinberg School of Medicine, Chicago, USA.

OCT instruments

The Cirrus 5000 SD-OCT system from Carl Zeiss Meditec has two different detectors that operate at different scan speeds (27 mHz for OCT imaging and 68 mHz for OCT angiography (OCTA)).

Dr Tanna said he believes that these differences in scan speed and resolution among the different SD-OCT platforms result in differences in image quality.

He demonstrated that the Spectralis OCT2 system from Heidelberg Engineering has exceptional image quality and very high effective resolution because its 85 mHz scan speed allows multiple scans to be obtained and averaged, and results in reduced motion artefact.

Normative databases are important. All of the instruments have robust ethnically diverse normative data. However, a drawback for all of the OCT devices is that a comparison of a specific patient to his or her ethnic group within the database is not possible. Patients are compared to an age-similar group of norms, Dr Tanna noted.

Another difference is the manner in which the macular thickness is measured among the instruments. “For clinicians interested in this parameter, this is an important difference to recognise among these machines,” he said.

When evaluating macular thickness for glaucoma diagnosis and monitoring, the Cirrus instrument reports the thickness of the ganglion cell layer and the inner plexiform layer (GCiPL).

The Avanti instrument (Optovue) reports the ganglion cell complex (GCC); that is, everything from the internal limiting membrane to the inner plexiform layer.

The Spectralis instrument can measure and report the entire macular thickness or the thickness of individual retinal layers in the macula—the retinal nerve fibre layer (RNFL), ganglion cell layer or inner plexiform layer.

Cirrus offers a robust method for evaluating serial macular GCiPL or peripapillary RNFL scans for the detection of progression.

The Avanti and Spectralis devices also offer methods of evaluating serial scans for progression detection; however, at present the clinician must determine whether an observed change is statistically meaningful.

The Cirrus optic nerve head and RNFL analysis printout includes an RNFL heatmap, the thickness deviation of the RNFL compared to the normative database, and tomograms that should be reviewed for segmentation errors or other artefacts.

The Ganglion Cell Analysis printout includes a heatmap of the GCiPL thickness, the deviation of the GCiPL thickness compared to the normative database, and one SD-OCT tomogram through the macula that should be reviewed for artefacts.

This can sometimes disclose pathology such as macular edema or an epiretinal membrane that may have been missed clinically.

“The great power of the Cirrus instrument, in my opinion, is the methodology and analytics for looking at disease progression,” he said, and demonstrated the nerve fibre layer and the macular thicknesses obtained at different time points in a patient whose disease worsened over time.

“Most importantly, the instrument provides an analysis that facilitates complex comparisons.

IN SHORT

Among the three most popular optical coherence tomography and angiography devices, there are important differences in hardware, resolution, and the manner in which data are analysed and displayed.
between the current and previous scans,” Dr Tanna explained. “The instrument also provides rates of change of various index averages and compares the thickness profiles along a 3.4-mm circular scan.”

The Spectralis OCT2 printout includes a confocal scanning laser ophthalmoscopy image of the posterior pole; a heatmap of the macular ganglion cell layer thickness (or a choice of other retinal layers); and the RNFL thickness profile along a 3.4-mm circular scan centered on the optic disc.

Other data

Other reported data are the minimum rim width along the Bruch’s membrane opening (BMO-MRW) and numerical and colour-coded graphical comparisons of sectors in the RNFL and BMO-MRW with the normative database.

Regarding changes in serial scans obtained over time, the machine highlights the changes and the amount of thinning compared with the baseline scan, but the clinician must determine the statistical relevance of that change.

For all the instruments, the clinical relevance of any detected change must be determined by the ophthalmologist.

An effective approach is to include a heatmap of the RNFL and a deviation map of the macular compared to the normative database along with colour-coded graphical comparisons of the 3.4-mm circumpapillary RNFL profile and sectors with the normative database.

The analytics for change over time provide various displays including, for example, heatmaps of the GCC and RNFL thickness and linear regression analyses of the rates of change over time.

The instrument is also capable of providing a change analysis compared to the normative database for the macular GCC, Dr Tanna pointed out.

OCTA

All of the previously mentioned devices have OCTA capability; however, regarding pricing, for each instrument OCTA is an add-on feature. The big difference among the devices, Dr Tanna noted, is that analytics relevant to glaucoma are only available with the Avanti device.

Conclusion

“All devices have strong evidence-based support for the concept that the changes seen in structure particularly that of the RNFL, are predictive of future visual field changes,” he said.

Dr Tanna noted that the Cirrus analytics, particularly for progression, are very strong.

“For Avanti, the OCTA analytics are very powerful and we do not have meaningful glaucoma-relevant analytics for the others,” Dr Tanna concluded. “For the Spectralis, the scan speeds are very high, resulting in superior effective resolution.”

**DR ANGELO P. TANNA, MD**

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This article is based on Dr Tanna’s presentation at the American Glaucoma Society 2019 annual meeting in San Francisco. Dr Tanna is a consultant to Carl Zeiss Meditec.
CASE HISTORY

I have been an emmetrope all of my life and enjoyed being spectacle-free until age 45 when I started to wear reading glasses because of presbyopia. The need for glasses evolved from being a minor inconvenience to a frustrating situation because I often found myself wasting time looking for my glasses or wasting money replacing ones that I had lost or accidentally sat on and broken.

To avoid needing glasses, I tried contact lens monovision, wearing a lens in my non-dominant eye for near vision. Functionally, it worked well for me, but my eye with the contact lens became red, which led some patients to ask me if I had an infection. Because of the reactive irritation, I reverted to wearing reading glasses with its related annoyance and frustration.

About 12 months ago, at the age of 63, I began to think seriously about refractive surgery to correct my presbyopia, and I decided to undergo PRESBYOND Laser Blended Vision. I was very comfortable choosing laser surgery because I had personally performed approximately 50,000 laser vision correction procedures when I was practicing as a refractive surgeon. I was also very comfortable choosing PRESBYOND because my surgeon was Dan Z. Reinstein, MD, MBA, who has been a respected colleague of mine for many years.

I scheduled a visit with Dr. Reinstein for an evaluation, and he found that I was a very suitable candidate for PRESBYOND. The fact that I had been using monovision and tolerated the anisometropia made me a good candidate. Based on the in-office assessment and my history of monovision, the plan was to target -1.5 D of anisometropia.

The PRESBYOND procedure is performed using the VisuMax femtosecond laser for the flap and the MEL 90 (or MEL 80) excimer laser to perform a customized ablation profile that is created with proprietary software for the CRS-Master workstation (all Carl Zeiss Meditec AG, Jena, Germany). The centers where I worked as a refractive surgeon used the IntraLase Femtosecond laser, and during my PRESBYOND procedure, I regretted that I never had the opportunity to use the VisuMax because I believe it provides a truly superior experience for patients. Whereas the flap-cutting procedure can be very uncomfortable for patients using an IntraLase laser because it has a flat applanation surface and requires higher suction, the VisuMax has a low-suction curved patient interface, and I felt nothing unpleasant.

My vision was blurry during the procedure, which took less than 10 minutes and seemed to be done even more quickly as I listened to Dr. Reinstein explaining everything that he was doing. When I was operating, I also provided commentary to patients during their procedures, and in my reversed role I confirmed my belief in its benefit for reducing patient apprehension and maintaining comfort.

I was able to see well immediately after the procedure, and by the next day I had functional uncorrected near, intermediate, and distance vision. I was astounded by the speed of my visual recovery because I expected it would take a while before I would be able to see clearly. My refractive data are listed in the table.

Binocularly, my uncorrected visual acuity is 20/20 at distance N5 at intermediate, and N4 for near.

I am appreciating the benefit of my successful PRESBYOND treatment in my daily life. My medical work involves working at a computer to write reports for my cases, and it involves a significant amount of reading. I am now able to do both tasks comfortably without glasses.

In addition, my contrast sensitivity was essentially unchanged after the procedure. Therefore, I am able to read menus in dimly lit restaurants without glasses, and I have no problems driving at night. If I close my

Table 1: Preoperative and postoperative manifest refraction

<table>
<thead>
<tr>
<th>Visit</th>
<th>Right eye</th>
<th>Left eye</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preoperative</td>
<td>+0.75 -0.75 x 133</td>
<td>+1.00 -1.00 x 79</td>
</tr>
<tr>
<td>Day 1</td>
<td>-0.50 DS</td>
<td>+0.00 DS</td>
</tr>
<tr>
<td>Month 1</td>
<td>-1.75 -0.25 x 155</td>
<td>+0.25 -0.50 x 170</td>
</tr>
<tr>
<td>Month 3</td>
<td>-1.50 -0.25 x 150 (N4)</td>
<td>+0.25 -0.25 x 180 (20/20+1)</td>
</tr>
</tbody>
</table>
CASE STUDIES

distance eye, I see some starburst around light sources in my near vision eye, but the symptom is minimal, not bothersome at all, and really not noticeable with both eyes open.

I think that some refractive surgeons have a favorite procedure for addressing presbyopia, and some surgeons that I know have cautioned me that there is a potential for refractive regression after PRESBYOND. Although I am only almost 6 months out from my surgery, my refraction and visual acuity have been stable, and I am not concerned about regression. I accept that I may need an enhancement sometime in the future, but I will confront that situation if and when it occurs.

DISCUSSION

PRESBYOND allows for a laser procedure that combines a small amount of anisometropia (≤1.5 D) with a controlled amount of spherical aberration that is created using a non-linear aspheric ablation profile to increase depth of field (Figure 1). I would describe PRESBYOND as monovision on steroids because of its many advantages.

Conventional monovision worked well for me, but there are people who cannot tolerate the anisometropia, even becoming dizzy and nauseous. The low level of anisometropia created with PRESBYOND is much better tolerated, and stereoacuity is also maintained after the PRESBYOND procedure. Although patients need to be counseled to expect a period of neuroadaptation after the surgery, I believe that its duration is relatively short for most patients because of the relatively small inter-eye difference in refraction targeted with PRESBYOND. In addition, unlike conventional monovision, the blended vision created by PRESBYOND delivers continuous quality vision from near to far.

Emmetropic patients have other surgical options for presbyopia correction. If I had any cataract, I would have considered lens removal with monofocal IOL implantation to create pseudophakic monovision. I would not have chosen multifocal IOL implantation, however, because I have seen too many patients affected by disabling glare and halos with that technology. My natural lenses are still clear, however, and I do not expect them to change soon considering that my father was 84 years old when he came to need cataract surgery. Therefore, I could not justify exposing myself to the potential sight-threatening risks of intraocular surgery.

I did not consider a corneal inlay procedure at all. I had been on the medical advisory board for two companies that market corneal inlays, and I was initially enthusiastic about the outcomes in the cases I performed while I was practicing refractive surgery. However, I began to see patients who were having severe problems with haze. Therefore, I concluded no good can come from having a foreign body in the cornea, I stopped doing inlay procedures, and I resigned as an advisor to the manufacturers.

CONCLUSION

In any situation where there are options for management, many patients ask their physician for advice based on their trust in the provider’s expert knowledge and experience. I believe that there is no more compelling recommendation that a physician can provide than one that is based on personal experience. When I was practicing refractive surgery, patients would question whether I actually believed in the efficacy and safety of laser vision correction if they saw me wearing my reading glasses. If I was still performing laser vision correction today, I would certainly implement PRESBYOND, and I believe my personal success and satisfaction with the procedure would give patients great comfort and confidence in choosing the procedure.

Although I cannot personally offer PRESBYOND to patients, I have recommended it to several people that I know and encouraged them to schedule a consultation with Dr. Reinstein. Considering my experience, I have no doubt that if I were to go back to the time when I was deciding what I should do to eliminate my need for reading glasses, I would not hesitate to choose PRESBYOND again.

Figure 1: Postoperative axial curvature maps

Emmetropic patients have other surgical options for presbyopia correction. If I had any cataract, I would have considered lens removal with monofocal IOL implantation to create pseudophakic monovision. I would not have chosen multifocal IOL implantation, however, because I have seen too many patients affected by disabling glare and halos with that technology. My natural lenses are still clear, however, and I do not expect them to change soon considering that my father was 84 years old when he came to need cataract surgery. Therefore, I could not justify exposing myself to the potential sight-threatening risks of intraocular surgery.

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A expanded indication for aflibercept injection (Eylea, Regeneron) is now approved by the FDA to treat all stages of diabetic retinopathy (DR).

The approval is significant in that, for the first time, an anti-vascular endothelial growth factor (VEGF) agent has been evaluated and approved in patients with moderately severe to severe non-proliferative diabetic retinopathy (NPDR).

“The PANORAMA trial marks the first time we have a prospective, multicentre, double-masked, randomised, controlled trial evaluating these high-risk NPDR eyes without diabetic macular edema (DME),” said Charles C. Wykoff, MD, PhD, Retina Consultants of Houston, TX, USA.

The study showed that clinicians can not only improve the Diabetic Retinopathy Severity Scale (DRSS) score, but can also prevent sight-threatening complications, the development of PDR and the development of centre-involved DME, explained David Brown, MD, FACS, an investigator for the PANORAMA trial, and director of research, Retina Consultants of Houston.

In essence, physicians can turn an eye with 20 years’ of diabetic damage into one that only has 10 or 15 years of damage, Dr Brown added.

“What gives patients another 10 or 15 years to take better care of themselves, improve blood sugars and improve cholesterol levels,” he said. “Most patients are in denial until they get an end-organ problem like kidney failure, DR, or nephropathy. We now can help mediate some of that end-organ damage.”

For the treatment of DR, aflibercept may be dosed every 8 weeks following five initial monthly injections, or every 4 weeks.

What PANORAMA found
The FDA approval was based on 6-month and 1-year results from PANORAMA, a phase III trial that enrolled 402 patients and was designed to investigate the improvement of moderately severe to severe NPDR without DME, compared to sham injection.

PANORAMA is the first prospective trial to study whether an anti-VEGF can also help prevent worsening disease in patients with NPDR without DME. “All of our previous DR analyses come from eyes with proliferative diabetic retinopathy (PDR) or NPDR with DME,” Dr Wykoff said. “This the first time we have NPDR without DME. It’s an important landmark trial for that key reason.”

An ongoing issue for physicians is that with proliferative disease, “the downside is too high for most doctors and patients for noncompliance,” Dr Brown said, noting most patients have been noncompliant for decades with other aspects of their diabetes control.

“To me, it’s a much easier argument to treat NPDR, because what would I have done for them otherwise? Nothing,” Dr Brown said.

With the option to dose every 4 or 8 weeks and individualise therapy, Dr Wykoff noted it is “good to be able to have more frequent dosing on-label.”

The PANORAMA trial evaluated a q16 arm as well and those patients did well, he added.

“They did equally well to the q8 arm through 6 and through 12 months,” Dr Wykoff said. “Both arms were highly statistically significantly better than sham. In the real world, monthly and even every-other-month dosing is impractical for many patients, and the q16 arm speaks to that.”

The safety outcomes in PANORAMA were similar to what was found in the pivotal phase III studies on aflibercept for DME.

‘This the first time we have NPDR without DME. It’s an important landmark trial for that key reason.’
– Dr Charles C. Wykoff

IN SHORT
The PANORAMA study shows aflibercept can improve diabetic retinopathy scores and prevent sight-threatening complications.
“MICRO FEATHER” New Slit Knife has the best quality on an unprecedented level, produced from a combination of the ultra-precision sharpening technology that FEATHER has cultivated during 85 years of blade manufacturing and the latest specialty blade edge processing. Especially for sclerocornia centesis incisions during cataract surgery, this knife shows superior performance with its stable sharpness of low resistance value.

STABBING RESISTANCE COMPARISON

*In-house comparison by stabbing swine eye. Lower resistance value indicates better sharpness of the blade. (Based on in-house inspection data)

<table>
<thead>
<tr>
<th></th>
<th>Competitor A</th>
<th>Competitor B</th>
<th>FEATHER</th>
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<tr>
<td>High</td>
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<td></td>
</tr>
<tr>
<td>Low</td>
<td></td>
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</tr>
</tbody>
</table>

SPECIFICATIONS
- 5 pieces per box
- Gamma sterilized
- Bevel-up
- Blade width:
  - 1.4mm / 1.6mm / 1.8mm
  - 2.2mm / 2.4mm / 2.75mm / 2.8mm
  - 3.0mm / 3.2mm

Manufactured by
FEATHER SAFETY RAZOR CO., LTD.
OVERSEAS TRADE DIVISION
3-70, SHIYODO MINAMI 1-Chome, KITA-KU, OSAKA 534-0075, JAPAN
PHONE +81-6-6458-1638 FAX +81-6-6458-1611
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Although there was improvement in visual acuity scores, these were not statistically different between the two aflibercept arms, and neither of the groups improved by more than 1.5 letters.

Clinical signs of high-risk NPDR, such as intraretinal microvascular abnormalities and venous bleeding, indicate level 53 on the DRSS scoring—and about 40% of these patients will develop proliferative disease within a year, Dr Brown said.

With the new approval, however, “we’re going to be treating patients before they get into trouble as opposed to waiting until the plane’s nose-diving and you’re dumping fuel,” he said.

“Even if you treat with just the loading dose, we’ll be able to knock them down to the low-level 53 and out of high-risk NPDR and a moderate or mild NPDR in almost all of them,” Dr Brown said. “Those are the patients that make the most sense to treat.”

Dr Wykoff said that anatomically, there is strong evidence that anti-VEGF therapy provides “dramatic benefit”, both through improving DR severity levels and decreasing the development of PDR and centre-involved DME.

“Through 1 year, we have seen that the haemorrhages get better and that fewer eyes develop PDR and DME, but we have not yet seen functional data,” he noted. “That is, does earlier treatment, before eyes develop PDR or DME, result in better long-term functional outcomes or a decrease in treatment burden? Such data would be valuable.”

The q16 arm pushed the envelope to see what dosing frequency was necessary to maintain improvements. The hope is “less-frequent dosing will allow improved compliance,” Dr Wykoff said.

Since it remains unknown how often clinicians ideally should be treating patients, the data set from PANORAMA is likely to be a starting point.

“Fortunately, PANORAMA is a 2-year trial, and visual field is one of the endpoints. I look forward
to collecting more functional endpoints evaluating the value of earlier intervention,” said Dr Wykoff, who added that the Diabetic Retinopathy Clinical Trial Retina Network is also evaluating anatomic and functional endpoints in the ongoing Protocol W. Including this expanded approval, aflibercept is indicated for the treatment of wet age-related macular degeneration (AMD), macular edema following retinal vein occlusion (RVO), DME and DR.

<table>
<thead>
<tr>
<th>Mild NPDR</th>
<th>Moderate NPDR</th>
<th>Moderately severe NPDR</th>
<th>Severe NPDR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absence of microaneurysms or other characteristics</td>
<td>One or more: venous loops, hard exudates, soft exudates, retinal haemorrhages; other characteristics questionable or absent</td>
<td>Both moderate NPDR characteristics plus more extensive IRMA, more severe haemorrhages and microaneurysms, or definite venous beading</td>
<td>More extensive characteristics than moderately severe NPDR but without neovascularisation of disc or retina</td>
</tr>
</tbody>
</table>

### Diabetic Retinopathy Severity SCALE (DRSS)

| PDR is characterised by neovascularisation of the disc and/or retina, vitreous haemorrhage, preretinal haemorrhage, which become more severe as levels advance |
|---|---|---|---|
| Mild PDR | 10 | 20 | 35 |
| Moderate PDR | 43 | 47 | 53 |
| High-risk PDR | 60, 61 | 65 | 71, 75 |

### DR CORRESPONDING DR STAGE

<table>
<thead>
<tr>
<th>Damage to the retina observed</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRSS Score</td>
</tr>
</tbody>
</table>

### Diabetic Retinopathy Severity SCALE

- **DR DAVID BROWN, MD, FACS**
  E: dmbmd@houstonretina.com

- **DR CHARLES C. WYKOFF, MD, PHD**
  E: ccwmd@houstonretina.com

Both Drs Brown and Wykoff are consultants and researchers for Regeneron.

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Lasers in diabetic retinopathy: Choosing the right scenario

Focal laser has a role in DME, although start of process may be deferred

Questions have arisen about the need for laser in diabetic macular edema (DME) and proliferative diabetic retinopathy (PDR), and the answers are yes and no, depending on the clinical scenario.

Generally speaking, laser is considered a valuable treatment, but the most current findings recommend that it be deferred for 6 months after the start of treatment with an anti-vascular endothelial growth factor (VEGF) drug when treating DME and focal laser is reserved for treating non-central DME.

For PDR, laser has a lower treatment burden; ultimately, eyes may fare better with ranibizumab, said John Wells, MD, chairman, Palmetto Health/USC Ophthalmology, West Columbia, SC, USA.

DME

Focal laser was the go-to therapy for DME until 2010 when the Diabetic Retinopathy Clinical Research (DRCR) Protocol I found that intravitreous injections of ranibizumab (Lucentis, Genentech Inc.) with prompt or deferred laser therapy at 6 months provided better results than focal laser when the DME involved the centre of the macula.

Prior to those findings, clinicians adhered to the Early Treatment of Diabetic Retinopathy Study (ETDRS) guidelines that recommended focal laser therapy because it reduced the risk of moderate visual loss in patients with clinically significant DME by about 50% at 3 years. However, importantly, any visual improvement was rare.

It is reasonable to apply the ETDRS guidelines when patients with DME have no central thickening, but observation is also reasonable considering that anti-VEGF therapy is available if the macular centre becomes involved.

“I think these results are important and should really influence our use of laser,” Dr Wells, emphasised.

A 5-year follow-up is available for the DRCR Protocol I study; however, the difference between the ranibizumab-treated patients in the prompt laser and deferred laser group became apparent as early as year 2. Dr Wells showed that the deferred laser group had improvements in the letter scores at the 2-year time point that were beginning to be superior to the prompt laser group and at 5 years that difference persisted.

A subgroup analysis showed that in patients with a baseline visual acuity (VA) of 20/50 or worse, the deferred laser group had an average gain of about 17 letters compared with an average of about ten letters in the prompt laser group, he reported.

‘I think these results are important and should really influence our use of laser.’ — Dr John Wells

“In addition, the deferred laser group was more likely to achieve three-line and two-line gains in vision than the prompt laser group,” he said. Interestingly, these gains in vision occurred despite the fact that similar decreases in the central macular thicknesses were seen on optical coherence tomography in both groups.

One disadvantage

A disadvantage associated with the deferred laser group was that more intravitreal injections were needed over the 5 years of the study, i.e. 17 injections versus 13 injections in the prompt laser group.

Another noteworthy observation was that 56% of patients in the deferred laser group never required a laser treatment.

“Adding laser at the initiation of ranibizumab was no better than deferring laser for at least 24 weeks. Deferring laser might be associated with greater VA gains,” Dr Wells said.

IN SHORT

▶ Laser maintains a place for treating non-centre-involved diabetic macular edema, and is reliable for treating proliferative diabetic retinopathy.
gains through 5 years, especially in eyes with worse VA at baseline,” Dr Wells commented.

He theorised that the larger number of injections in the deferred laser group might have resulted in the better VA or the use of laser in the prompt laser group might have been detrimental to the macula.

‘Despite more laser treatment, no differences were seen in the VA among the three groups at the 1- or 2-year time points, indicating that laser did not provide a benefit.’

— Dr John Wells

The DRCR Protocol T, in which aflibercept (Eylea, Regeneron Pharmaceuticals), bevacizumab (Avastin, Genentech Inc.), and ranibizumab were compared in patients with DME, also shed light on the use of laser for centre-involved DME. The patients received similar numbers of intravitreal injections, but significantly (P<0.001) more patients in the bevacizumab group underwent laser treatment.

“Despite more laser treatment, no differences were seen in the VA among the three groups at the 1- or 2-year time points, indicating that laser did not provide a benefit,” Dr Wells said.

Subgroup analyses based on a baseline VA of 20/50 or worse and reduction of edema showed that the bevacizumab group was inferior to the other two groups. The aflibercept group with the least amount of laser had the best visual outcomes.

In both the Protocol I and T, persistent DME was problematic, which might be a scenario for use of micropulse laser or targeted panretinal photocoagulation (PRP) for peripheral ischemia, Dr Wells explained. Currently, little randomised trial data are available for the former, and the latter did not appear effective.

The bottom line is that focal laser has a role in DME but should be deferred for 6 months and anti-VEGF therapy is the primary treatment for centre-involved DME. ETDRS recommendations can be followed in the absence of central macular involvement.

PDR

Protocol S compared PRP with intravitreal ranibizumab in patients with PDR. The results showed that ranibizumab alone was superior to PRP plus ranibizumab in eyes with both PDR and DME at 2 years, but that benefit decreased by the 5-year time point.

Generally, at 2 years, ranibizumab provided better VA outcomes, less visual field loss, fewer vitrectomies were required, and less development of centre-involved DME compared with the PRP group.

The advantages of PRP were fewer visits and injections and greater cost-effectiveness in eyes without DME initially. More than half of patients in the PRP group needed supplemental laser during the first 2 years of the study (51% versus 14%).

The VA results at 5 years were similar in both groups as were the changes in the letter scores.

The mean changes in the VA over the course of the study in the eyes with baseline DME indicated an early benefit for the ranibizumab group that disappeared at 5 years. In the eyes without DME at baseline, little difference was seen in the VA over the course of the study.

Visual field preservation was significantly greater in the ranibizumab group compared with the PRP group, but that difference began to decrease at 2 years; at 5 years, the ranibizumab benefit was lower but still greater than PRP.

“Despite the fact that the benefits of ranibizumab for vision and visual fields decreased over time, the secondary complications of PDR, such as development of DME, tractional retinal detachment, and the need for vitrectomy, were less in the ranibizumab group compared with the PRP group over 5 years,” Dr Wells said.

The vitreous haemorrhage rates were similar in both groups.

‘Laser still has a role in the management of diabetic retinopathy.’

— Dr John Wells

Dr Wells advised that the treatment benefits should be weighed against the increased treatment burden and the risk of non-compliance with ranibizumab monotherapy for PDR.

According to the findings, the mean change in VA was similar in the PRP and ranibizumab groups and the loss to follow-up was high in both groups. The PRP group was associated with a lower treatment burden with similar outcomes.

“Laser still has a role in the management of diabetic retinopathy,” Dr Wells concluded. “In DME, focal laser is reasonable for treating non-central DME. When the DME is centre-involved, laser should be deferred for 6 months. In PDR, laser is a viable treatment option that carries a lower treatment burden. However, the rates of secondary complications of PDR are higher than in eyes treated with ranibizumab.”

DR JOHN WELLS, MD
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This article was adapted from a presentation by Dr Wells at the 2018 American Association of Ophthalmology meeting.
Dr Wells is a consultant and investigator for Genentech and an investigator for Regeneron Pharmaceuticals.
A new tool, the Retina Risk App, was released recently by Risk Medical Solutions (RMS) to help patients with diabetes assess their risk for the development of diabetic eye disease. What sweetens this news even more is that the app is free and usable with both Android and iOS operating systems.

“This mobile app should empower patients to better understand their own risk profiles for eye disease and motivate them to modify their personal risk factors,” Einar Stefánsson, MD, PhD, emphasised.

The availability and importance of a tool such as this is underscored by how pervasive diabetes has become. Dr Stefánsson noted, “The global diabetes epidemic has tripled since 2000, to some 430 million persons worldwide, and is expected to exceed 600 million by 2045. Two-thirds of persons with diabetes develop diabetic retinopathy and one-third develop sight-threatening diabetic retinopathy over 20 years. These patients are at high risk of visual impairment or even blindness if not diagnosed and treated in a timely manner.”

The upside to this scenario is that routine eye screening and preventive treatment dramatically reduce blindness that develops as the result of diabetes, which is where the Retina Risk App comes into play.

Dr Stefánsson and Arna Gudmundsdottir, MD, co-founders of RMS, explained, “The Retina Risk App is a clinically validated risk calculator that allows people with diabetes to assess in real-time their individualised risk for development of sight-threatening diabetic retinopathy, based on their risk profile. It includes detailed guidelines and useful information on diabetes, diabetic retinopathy, and improved self-care, and helps patients to better understand their condition and become active participants in their own wellness journey,” they commented. Dr Stefánsson is professor of ophthalmology and physiology, University of Iceland, National University Hospital, Reykjavik, and Dr Gudmundsdottir is a diabetologist at Landspitali University Hospital, Department of Endocrinology, the National University Hospital, Reykjavik, Iceland.

**Key features of the Retina Risk App**

These include individualised and free risk assessment for diabetic retinopathy; customised, easily understandable information with clear guidelines; patient educational material that improves diabetes management and quality of life; ability to track progress; ability to export and share results; and goal setting.

The major characteristic of the App is that it empowers patients with diabetes to become more involved in their health care decision-making. This fits very well with the latest American Diabetic Association/European Association for the Study of Diabetes consensus guidelines on management of hyperglycemia that have a special emphasis on patient-centered care and shared decision-making. It supports patient self-management by demonstrating the importance of regular eye examinations and seeking timely medical assistance. It motivates them to become more responsible and better informed, and its educational tools demonstrate how improvement...
of modifiable risk factors, that is, e.g., blood glucose, haemoglobin A1c, and blood pressure, can significantly lower the risk of serious diabetic eye disease and expensive interventions, Drs Stefánsson and Gudmundsdottir pointed out.

The app algorithm

The proprietary algorithm used in the app was validated clinically in 20,000 persons with diabetes and the results published in several medical journals that are accessible on the app website. The algorithm calculates patients’ annualised risk of developing sight-threatening diabetic retinopathy based upon major, well-established risk factors for the development of sight-threatening diabetic retinopathy.

The algorithm was validated clinically in Northern European diabetes cohorts, which include a variety of races and ethnicities. Future validation in other populations is planned. The investigators explained that the processes implicated in sight-threatening diabetic retinopathy in all populations depend predominantly on metrics in the algorithm that include blood glucose control and status, blood pressure, disease duration, gender, diabetes subtype, and the presence or absence of non-proliferative retinopathy.

While the algorithm accounts for 80% of established risk in patients with diabetes based upon a preponderance of research data, there are other emerging factors including obstructive sleep apnea, obesity, and a history of other diabetes complications, that probably account for some of the remaining risk and may very well be important for refinement of predictive power. More detailed analysis of the fundus image, for example, with artificial intelligence and the addition of oximetry is likely to further increase the power of the personal prediction from the current 80% to well over 90%. Dr Stefánsson stated: “The personalised report form generated for each patient should allow health care providers to communicate the presence of at least some of these emerging risk factors and recommend additional preventative strategies for patients based upon clinical judgment and new research findings”.

The app also answers frequently asked questions that help educate patients about their diabetes and diabetic retinopathy and a blog.

“Our vision is to improve diabetes care and transform diabetes education and care by applying technology and epidemiologic data to improve outcomes, focus on patients at the highest risk, and save money. This is mobile, digital health at the user’s fingertip,” Dr Stefánsson concluded.

Information about the Retina Risk App, which currently is available in 23 languages, can be accessed at https://www.retinarisk.com/about/.

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Drs Stefánsson and Gudmundsdottir cofounded RMS in 2009.
Numerous studies over the past decade have shown the implantation of intrastromal corneal ring segments (ICRS) to be a safe and effective means of improving visual acuity and reducing the refractive error and mean keratometry in keratoconic eyes.¹

We have routinely treated keratoconus and other corneal ectatic disorders with ICRS implantation for over a decade now using different types of ICRS such as the Keraring (Mediphacos, Brazil) and Ferrara ring (Ferrara Ophthalmics, Brazil).

The main goals of the treatment are to correct the corneal ectasia, restore the regular prolate shape of the cornea, improve the associated refractive error and higher-order aberrations, and ultimately stop or at least delay the ectasia progression. More recently, we have started using the new asymmetric Keraring (AS) progressive thickness intrastromal ring segments, which are a welcome extension to the Keraring product line.

Properties and advantages

Similarly to the standard Keraring, the AS version is also made of polymethylmethacrylate (PMMA) with an ultraviolet blocker and a triangular prismatic cross section which is designed to mitigate visual disturbances in low light. It has a 5.0 or 6.0 mm optical zone. The key difference between the two models is in their thickness profiles; whereas the standard Kerarings have uniform thicknesses ranging from 150 μm to 350 μm in 50 μm steps, the Keraring AS presents a variable thickness within the same implant. For the 160º arc the thickness variations currently available are 150/250 μm and 200/300 μm. Thus, it is thin at one end and gradually increases the thickness at the opposite end. For the 160º arc there are options of clockwise or counterclockwise direction of thickness increase while for the 330º arc there are available also 150/250 μm and 200/300 μm thickness variations model. Also available is a model that is thinner at both tips and thicker at the centre of the arc segment (Figure 1).

The Keraring AS is indicated for the treatment of asymmetric keratoconus cases and produces a progressive flattening effect that allows for customisation of corneal remodelling according to the needs of each individual case.

‘The new AS segments represent a significant advance on current ICRS models.’

− Dr Tiago Monteiro

By Dr Tiago Monteiro

Towards a customised treatment of patients with keratoconic eyes

New design increases options for patients with corneal ectatic disorders

(Figure 1) The new asymmetric Keraring (AS) progressive thickness intrastromal ring segments. (Images courtesy of Dr Monteiro)
The new AS segments represent a significant advance on current ICRS models. Major progress has been made in recent years in classifying keratoconus into several distinct categories based on the phenotype and morphological characteristics of the disease, thanks to the work and publications of Professor José Alfonso and his colleagues from the Instituto Oftalmologico Fernandez-Vega, Oviedo, Spain. Yet, although several distinct phenotypes of keratoconus have been identified, we could still only propose ICRS solutions that did not fully take account of the specific disease profile of each patient.

The Keraring AS overcomes that obstacle for treatment of asymmetric keratoconus and enables us to use different ICRS combinations in order to offer a truly customised solution to our patients. With over 40 variations of thickness, arc length, and diameter now available in entire range, we can effectively mix and match segments to correct the ectasia and tackle astigmatism and higher order aberrations such as coma in one simple procedure.

Other advantages include:

- The same indication and contraindication criteria as classic Keraring ICRS.
- There is no steep learning curve: the surgical technique is the same as for traditional ICRS using either manual methods or femtosecond laser to create the intrastromal pocket to implant the ring.
- Enhanced customisation also results in better visual and refractive results for patients.
- The procedure is reversible and adjustable and can be combined, if necessary, with crosslinking to further stabilise the cornea.

**Indications**

Our main indications for Keraring implantation are keratoconus with reduced best-corrected visual acuity (BCVA) and contact lens intolerance, pellucid marginal degeneration, post-LASIK ectasia, and high amounts of regular or irregular astigmatism after penetrating keratoplasty. The Keraring AS is ideal for cases of asymmetric keratoconus where the topographic flat axis is divergent from the coma axis by more than 30°.

In our experience, the ideal patient profile for ICRS implant is a young keratoconus patient with no extensive central corneal opacity or severe atopic disease who is not comfortable wearing rigid contact lenses and who desires a better visual acuity and enhanced quality of life. Chair time is vitally important in order to properly educate patients about keratoconus and the objectives of the Keraring procedure so that they have realistic expectations.

**Surgical technique**

The surgical technique begins with construction of an intrastromal tunnel at a depth equivalent to 75% of the corneal thickness followed by implantation of the Keraring segments. Surgeons have the choice to either dissect the tunnel mechanically using special instrumentation or to use a femtosecond laser. We prefer the latter approach as it is more predictable and consistent than the mechanical technique and leads to better visual outcomes. Once the ring segments have been implanted, a bandage contact lens is applied and left for two to three days and steroids and antibiotic eye drops are prescribed for one to two weeks postoperatively.

**Surgical pearls**

The most important pearl for this type of surgery starts with the preoperative assessment:

− Dr Tiago Monteiro

Nowadays, concepts such as quality of vision and aberrometry are part-and-parcel of the treatment process. The new nomograms for intracorneal segments are based on criteria such as subjective refraction, axial curvature, aberrometry (coma and other higher order aberrations), corneal asphericity and the location of the thinnest point of the cornea.

![A](image1.png)  
![B](image2.png)  

*FIGURE 2* Right (A) and left (B) eye implanted with the Keraring AS.
In keratoconus, there are three main vectors of astigmatism that need to be analysed in order to choose the correct implant: the topographic axis, the subjective astigmatism axis derived from the manifest refraction of the patient, and finally the coma aberration axis. Coma is the most important higher order aberration that has an impact on vision in keratoconus patients, so it is very important to correct this in order to obtain optimal visual outcomes.

The bottom line is that if the surgeon can understand and interpret the relationship between the various axes—topographic, refractive and aberrometric—then they will develop better nomograms and deliver better results for their patients.

The manufacturer also proposes a nomogram based on the Alfonso morphological classification of keratoconus which may be accessed via www.keraring.online.

Another important tip is to treat any ocular surface disease—allergic conjunctivitis and dry eye are frequently found in keratoconus patients. This applies irrespective of whether the surgeon plans to use rigid contact lenses, ICRS, corneal crosslinking, or a combination of these to treat the keratoconus.

We also stress to the patient the importance of avoiding eye rubbing as there is growing evidence that it is associated with progression of the disease.

**Conclusion**

Our initial experience suggests that Keraring AS has an effective remodelling effect on the cornea and delivers excellent refractive outcomes in eyes with asymmetric keratoconus. We have already started gathering data and, on an initial subset of 15 patients implanted with the ring segments, the refractive and anatomical outcomes were excellent. Further prospective, long-term studies are needed to confirm the safety of the ring segments in these young patients. This latest design increases our options for customising our treatment plans for patients with corneal ectatic disorders.

**REFERENCES**


“This latest design increases our options for customising our treatment plans for patients with corneal ectatic disorders.”

— Dr Tiago Monteiro
Corresponding with the evolution in techniques for endothelial keratoplasty (EK), there has been a debate over which procedure corneal surgeons should perform.

Going forward, the discussion will be about the battle between Descemet’s membrane endothelial keratoplasty (DMEK) and nano-thin Descemet’s stripping automated endothelial keratoplasty (NT-DSAEK), said Clara C. Chan, MD. Dr Chan is medical director, The Eye Bank of Canada (Ontario Division), and assistant professor of ophthalmology and vision sciences, University of Toronto, Toronto, Ontario, Canada.

“Surgeons performing DSAEK first migrated to ultrathin (UT) DSAEK, and now we will see migration to NT-DSAEK,” Dr Chan said. “The use of thinner graft tissue has benefits of a lower rejection rate, more predictable tissue handling, fewer detachments and lower rebubbling rates.”

“We know that, when compared with DSAEK using thicker grafts, DMEK seems to be associated with lower higher-order aberrations (HOAs) and faster visual recovery,” she said. “Studies are needed to compare long-term outcomes of DMEK with UT- and NT-DSAEK.”

Dr Chan reviewed published literature comparing outcomes with different EK techniques. She cited the 2008 American Academy of Ophthalmology (AAO) Ophthalmic Technology Assessment report on Descemet’s stripping endothelial keratoplasty (DSEK), noting that the first outcomes study on DSEK appeared in the peer-reviewed literature in 2005.

In 2006, the first report of DMEK appeared in the peer-reviewed literature. Thin DSAEK, using a graft with a thickness <130 μm, was first reported in 2011. By 2018, authors of an AAO Ophthalmic Technology Assessment concluded that DMEK was superior to DSEK/DSAEK in terms of providing faster vision recovery, better overall visual outcomes, a lower rejection rate, and less refractive error.

Authors of a systematic review and meta-analysis of DMEK and DSEK/DSAEK came to similar conclusions regarding the relative advantages and similarities of the two procedures, Dr Chan noted.

UT-DSAEK (graft thickness <100 μm) was described in 2011, and the first randomly selected controlled trial comparing DMEK and UT-DSAEK (average central graft thickness 73 μm) was reported this year. Patients included in the study had Fuch’s endothelial dystrophy or pseudophakic bullous keratopathy and were followed for 12 months after surgery.

The study found DMEK was associated with better best-corrected visual acuity (BSCVA) at 3, 6 and 12 months, but also that, later during the available follow-up, there was a trend for increased endothelial cell loss after DMEK compared with UT-DSAEK. There were no statistically significant differences between the two surgeries in rates of rebubbling, graft rejection or graft survival, although the study only included 50 eyes and may have been underpowered to evaluate these outcomes.

Analyses of posterior corneal HOAs showed a decrease from baseline in eyes that underwent DMEK, and an increase in the UT-DSAEK group. Total posterior corneal HOAs at 6 and 12 months were shown to correlate with better BSCVA outcomes in DMEK, consistent with previous reports, Dr Chan said.

The only published comparison of NT-DSAEK and DMEK is a prospective case series that includes 28 eyes with Fuch’s endothelial dystrophy. The surgeons evaluated BSCVA as the primary outcome and found it was better after DMEK at 1 month postoperatively, but similar for the two procedures at 3, 6 and 12 months. In addition, the percentage of eyes achieving BSCVA of 20/25 or better was similar in the two groups at 6 and 12 months.

Rebubbling was needed in one eye that had NT-DSAEK. There were no cases of graft rejection or failure.

IN SHORT

‘Nano-thin’ grafts have recently begun to be used for DSAEK. Long-term data are needed to see how the outcomes of this technique compare with DMEK.

By Cheryl Guttman Krader; Reviewed by Dr Clara C. Chan

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This article was adapted from Dr Chan’s presentation during the 2019 meeting of the American Society of Cataract and Refractive Surgery. Dr Chan has no disclosures.
Corneal endothelium characteristics vary depending on patient ethnicity

With ‘surprise’ finding, results may help indicate future corneal pathology

A study focusing on corneal endothelium changes found that an elderly Hispanic population had a high prevalence of polymegatism, pleomorphism and guttata, said Jorge Luis Domene Hickman, MD.

The results could help to indicate future corneal pathologies that may occur, said Dr Hickman, Ophthalmology and Visual Sciences Institute, School of Medicine, Monterrey Institute of Technology and Higher Education, Monterrey, Mexico.

**Diving deeper**
A total of 42 patients (22 male, 20 female) and 75 eyes were included in the study. All of the patients were at least 65 years old, with a mean age of 73.9 years.

Researchers assessed the central region of the corneal endothelium with specular microscopy (EM-3000, Tomey) to calculate the study’s corneal parameters, including corneal pachymetry.

Study participants were classified in 5-year age ranges (65−69 years, 70−74 years, etc.). All eyes were healthy. Exclusion criteria included previous ocular surgery, glaucoma and photocoagulation.

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**Polymegatism** was considered when the coefficient of variation of the cell area was higher than 40%.

**Pleomorphism** was considered when fewer than 50% of the cells were six-sided.

**Analysing results**

The mean cell density among patients was 2,268 cells/mm², with no statistically significant difference between males and females (p = 0.15).

The mean corneal thickness was 0.537 mm. The mean coefficient of variation was 42.04%; 44% of eyes had signs of polymegatism. The mean percentage of six-sided cells was 42.3%, with 76% of eyes having pleomorphism.

Also, 27% of patients had significant guttata. Three patients were diagnosed with Fuchs’ endothelial dystrophy, all of whom had polymegatism and pleomorphism (mean cell density: 1,152 cells/mm²).

**Unexpected ‘surprise’**

A surprise occurred among the nine patients aged over 85 years, Dr Hickman said. They had an above-average mean cell density (2,404 cells/mm²), a coefficient of variation of 36.9%, hexagonality of 46.6% and pachymetry of 0.545 mm.

Such research is useful for ophthalmologists who see patients with a Latin-American background, Dr Hickman said.

“Knowledge of the characteristics of the corneal endothelium is important to take the adequate measures during anterior segment surgery and to predict the evolution afterward,” he concluded. “These characteristics vary depending on patient ethnicity.”
Survey results: UK ophthalmology trainees mostly confident

After training in the UK, ophthalmologists are confident in their profession.

By Laird Harrison, CPT

By the end of their training, the majority of UK-trained ophthalmologists feel confident in most aspects of their profession, and most do not think the training should be shortened, a new survey shows [Dean et al. 2019; 33, 917–924].

At least 70% of respondents thought they could manage all aspects of medical ophthalmology listed in the survey. Penetrating keratoplasty was the only surgical procedure that fewer than 50% felt confident in handling.

Adopted in 2005, the UK policy Modernising Medical Careers shortened training for ophthalmologists to 7 years, yet they still spend more time studying their profession and learn more procedures than any other ophthalmology trainees in the world, according to William H. Dean of the London School of Hygiene and Tropical Medicine and colleagues, who authored the report.

At the same time, UK medical trainees are currently limited by the European Working Time Directive to a mean of 48 hours/week, averaged over 6 months. This may limit the total surgical training time available.

Four UK Departments of Health have recently adopted the Shape of Training plan to shorten training and make it more flexible while increasing the number of generalists.

The first class to study under the Modernising Medical Careers regimen recently graduated. To assess this scheme, Dean and colleagues sent a web-based questionnaire to all ophthalmology trainees in the UK. Their response rate of 188 out of 780 (24.1%) exceeded the minimum they calculated that they needed to achieve a 95% confidence level. The respondents were evenly divided among the 7 years of training.

Asked if ophthalmologist training should be shorter than 7 years, 34.4% of respondents agreed. “This opposition to shortening a very long training period reflects the high level of competence in diverse areas of ophthalmology expected from a newly qualified UK consultant,” the authors wrote.

Asked if their contracts reflected the actual number of hours they worked, 54.8% of the survey respondents agreed and 33.5% disagreed.

The number of procedures that UK ophthalmology trainees must complete exceeds that of other countries. For example, UK trainees must complete 350 full phacoemulsification procedures, while in the USA only 86 are required. Yet, 100% of respondents in both countries felt competent in the procedure by the time they had finished their training.

The UK trainees expressed confidence in most of their non-clinical skills, including communication with patients and colleagues, small group teaching and presenting at conferences. But 42% said they were not confident they could prepare a business case.

Asked about career preferences, the largest percentage (31.4%) chose oculoplastics, followed by vitreoretinal (25.1%), glaucoma (24.6%) and cornea (24.0%).

Most said they picked these subspecialties because of interest; only 11.7% gave “job opportunity” as a reason. In fact, these preferences do not appear to match the availability of “substantive” posts for consultant ophthalmologists in the UK, the authors wrote. Over a 1-year period, they noted that only 7% of advertised positions were for oculoplastics, 5% for vitreoretinal, 21% for glaucoma and 6% for cornea.

To increase appeal of less-popular subspecialties, they suggested engaging trainees through subspecialty associations and regional recruitment forums, and developing consultant job plans with dual subspecialisations or including subspeciality as a part of a generalist remit.

IN SHORT

UK training of ophthalmologists leaves students confident and is mostly considered to be the right duration, a survey shows.
Nidek introduces novel YC family of laser systems

Nidek Co. Ltd. presents the launch of the YC-200 S plus ophthalmic YAG and SLT laser system/YC-200 ophthalmic YAG laser system. The YC-200 S plus/YC-200 is the advanced successor to the YC-1800 laser. The YC-200 S plus/YC-200 of lasers builds on the popularity and technology of the YC-1800 by incorporating newer optical designs, engineering and software advances to ensure precise targeting of pathology, while ensuring efficacious treatments and enhancing surgeon visualisation of laser delivery.

The optical system improvements optimise resolution and contrast. An expanded focal depth and natural-colored bright LED illumination provide unparalleled views of the pathology and treatment.

Two rotatable aiming beams for YAG mode and a parfocal aiming beam for SLT mode help the surgeon accurately target pathology.

The company has included YAG laser system enhancements to the YC-200 S plus/YC-200 that achieve 1.6 mJ plasma threshold in air. These enhancements allow for robust, homogeneous laser energy delivery. The YC-200 S plus offers an advanced SLT mode that includes SLT-NAVI, which is an intuitive display of the real-time progress of laser treatment. An ergonomic design and optimised working distance minimise surgeon fatigue.

“The suite of technologies incorporated in the YC line of lasers allows surgeons to treat pathology with greater precision,” said Motoki Ozawa, president and chief executive officer of Nidek Co. Ltd. “The optical and software advances that we have incorporated in the YC lasers ensure safe and efficacious treatments that are delivered ‘right on the mark.’”

The YC-200 S plus/YC-200 is CE Mark approved but not yet cleared by the FDA.

For more information, go to www.nidek.com

Ophtec and VSA join forces in Argentina; RingJect gets US marketing approval

OPHTEC BV announced it has signed a partnership agreement with VSA to commercialise Ophtec’s products in the Argentinian marketplace.

The Precizon IOL line as well as the Artisan and Artflex line of iris-fixated IOLs are some of the products that will be commercialised by VSA. “Ophtec has a passion for vision and we look forward to continuing serving the Argentinian market and introducing out cataract lenses Precizon,” said Teresa Filhó, Ophtec’s export manager in a prepared statement.

Mauro Alvarez, sales director at VSA continued. “I am proud to introduce this new alliance between VSA Ata Complejidad and Ophtec in Argentina: it is undoubtedly a great opportunity to start working with such a prestigious company as Ophtec, which over its 35 years has remained faithful to his own ideas, always developing avant-garde concepts and products for the most demanding ophthalmologists.”

In other news, Ophtec USA has received FDA approval for the RingJect delivery system design optimisation changes. The device is a single use injector preloaded with the Ophtec Capsular Tension Ring (CTR).

The CTR is made of PMMA with patented compression molding technology, making for a durable, flexible device to stabilise the capsular bag in the presence of weakened or compromised zonules. The RingJect delivers the CTR, originally designed for use in complicated cataract surgery.

“We are grateful that the FDA has approved the Ophtec RingJect with optimised delivery system enhancements,” said Abraham Farhan, vice resident and general manager of Ophtec USA. “Our surgeons and patients will continue to benefit from our legacy Capsular Tension Ring (CTR). We are very excited about the RingJect, as it saves time in surgery and reduces surgical preparation time.”

For more information, go to www.ophtec.com

Implandata gains CE Mark for IOP measurement platform

Implandata Ophthalmic Products GmbH announced it attained CE Mark for its eye pressure measurement system (EYEMATE) for use in patients undergoing keratoprossthesis surgery. Keratoprosthesisis represents an infrequent yet important procedure for restoring vision; it is performed on patients whose donor cornea transplantation procedure has failed or shows only limited success. Increased IOP in keratoprossthesis patients is a frequent and major post-surgical complication, resulting in failure of the procedure, secondary glaucoma and, consequently, vision loss.

Implandata’s CE-certified and now commercially-available product allows ophthalmologists to detect increased IOP and to better manage the patient’s condition, minimising the risk of post-surgical complications and associated vision loss. This is particularly important given that keratoprossthesis patients are typically younger individuals, where preservation of vision is extremely important and costly. Implantdata’s proprietary eye pressure sensor is implanted in such patients in conjunction with the keratoprossthesis procedure, enabling continual monitoring of the eye pressure. Increased IOP can be detected early on and ophthalmologists are able to better manage challenging situations encountered in such patients.

For more information, go to www.implandata.com
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Oliver Findl, MD
Department of Ophthalmology
Hanusch Hospital, Vienna, Austria

A clear view of the surgical field when performing peelings is not the same with every microscope, as Dr. Findl has found. The superb optics of the OPMI LUMERA® 700 from ZEISS, together with the outstanding intraoperative OCT images, have given this innovative surgeon a new view on the procedure – helping him to rethink and refine his technique to achieve better outcomes. We share his commitment to his calling. What’s your calling?

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