APACRS EyeWorld
The news magazine of the Asia-Pacific Association of Cataract & Refractive Surgeons

Shaping Tomorrow's Vision:

Supplement to EyeWorld Asia-Pacific September 2019

SHANGHAI, China, April 2018—Having laid the foundation for modern optics at its inception, ZEISS (Jena, Germany) continues today to be a pioneer in the manufacturing of optical systems. Laying yet another milestone in its more than 170-year history, the company organized its most recent cataract and refractive surgery user meetings in combination—an acknowledgement of the blurring of the lines between the formerly distinct fields of anterior segment ophthalmic surgery.

This intersection between cataract and refractive surgery can be fraught with challenges, with refractive procedures potentially complicating later cataract surgery and cataract surgery potentially negating the benefits of earlier refractive procedures

ZEISS offers elegant solutions. In a rapid-fire session and video symposium, experts offered pearls for ensuring the best outcomes for patients, beginning with optimization of the ocular environment and the procedure itself. Meanwhile, the company leads the way with its new range of extended-depth of-focus (EDOF) IOLs, the AT LARA family of IOLs, which offer an even wider range of focus with excellent optical performance and quality of vision with fewer side effects. Moreover, the high degree of precision offered by ZEISS's refractive lasers and premium procedures such as small incision lenticule extraction (SMILE) leaves eyes better suited to the implantation of sensitive premium IOLs such as multifocals. Finally, ZEISS offers technologies such as the CIRCLE software that rounds out the company's cataract and refractive surgery solutions.

Optimizing cataract and refractive surgery

Tear film optimization

Conditions need to be optimized even before cataract and refractive surgery can begin to ensure the best possible outcomes, and one of the most obvious targets for this is the tear film. If the tear film is not optimized, said **Michael Lawless, MD**, Sydney, Australia, "it leads to trouble with accuracy, with less than ideal results, and unhappy patients, and you're not making the best of what surgery can offer."

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In particular, a non-optimized tear film will prevent patients from enjoying the full value out of high-quality lenses such as torics and procedures such as SMILE.

In addition, he said, a better tear meniscus results in better recovery of corneal sensation after LASIK, almost certainly after SMILE as well. Improved recovery leads to "a cascading set of good things."

But how do you get through the conflicting, confusing maze of what to do?

For his study, Dr. Lawless went right to the center of the confusing maze of ocular surface disease and picked out tear osmolarity. Looking at 1,150 consecutive refractive and cataract surgery consultations, patients who came in for vision correction over the 1-year period from October 2016 to October 2017, Dr. Lawless determined that tear osmolarity was the first test they underwent with trained technicians, before any drops were administered. The test was conducted in a controlled environment with known temperature and humidity.

Subjectively, 37% of patients felt their eyes were dry, with 21.8% using a lubricant. The mean tear osmolarity was 300.24±11.57 mOsm/L (range 217 to 368 mOsm/L) with a median of 299 mOsm/L, describing a bell curve. Following a standard cut-off value of >308 mOsm/L, 80.2% were normal, 19.8% hyperosmolar, but with a 316 mOsm/L cut-off, 92.5% were normal and only 7.5% were hyperosmolar. They also found a mean inter-eye difference of 8.7±8.3 (0 to 66), with a median of 6. Inter-eye difference in relation to osmolarity did not describe a bell curve—the higher the tear osmolarity, the bigger the inter-eye difference. They considered an inter-eye difference of 8 abnormal.

At their clinic, Dr. Lawless has standardized their approach beginning with tear osmolarity tests and the Ocular Surface Disease Index patient questionnaire in every patient to identify those with a tear film osmolarity of >308 mOsm/L and an inter-eye difference of 8 who will require treatment. Patients undergo a slitlamp examination and have their tear film optimized prior to IOL master biometry if for cataract surgery and prior to SMILE if for corneal laser surgery.

Preoperatively, they optimize the tear film with artificial tears, topical corticosteroids, oral fish oil, and lid scrubs. Dr. Lawless noted that this is not to cure dry eye, but only to optimize the film for better surgery results.

This protocol has improved the quality of their preop biometry, reducing suboptimal results from 40% to 5%. Dr. Lawless said that it has made preop assessment efficient and repeatable and ensures that patients are optimally prepared for both corneal laser and cataract surgery. Furthermore, issues are identified preop so there are no postop surprises, and no "difficult conversations" to be had with the patient a month after surgery. Finally, this process of tear optimization ensures patients are engaged in achieving better results for themselves.

Personalizing A-constants

The postop outcome has a close relationship with IOL calculation, and the A-constant plays a very important role in those calculations, said **Jiang Yaqin, MD,** China.

Dr. Jiang said that while many doctors think that the manufacturer-provided A-constant is sufficient, subjective factors can affect the value, including surgeon habits, incision type and quality, suture material, IOL design and structure, patient factors such as axial length, and choice of IOL formula.

In her experience, 90% of patients who were unhappy with their postop results had a residual refractive error, which in turn resulted from a non-optimized A-constant. Optimizing their A-constant according to postop refractive error, effective lens position, and the defocus curve of the particular IOL used gave Dr. Jiang's clinic an accuracy rate of 95%.

Currently, Dr. Jiang is actively optimizing A-constants for more IOLs, collecting a larger sample, and discussing the use of A-constants with different doctors. Surgeons at the clinic are looking into optimizing A-constants according to corneal curvature.

Dr. Jiang said that continuous A-constant optimization is important and necessary to achieve the best results after refractive cataract surgery.

Pearls for cataract and refractive surgery

Extending the range even further: The AT LARA family of EDOF IOLs

Ashvin Agarwal, MD, Chennai, India, introduced ZEISS's new IOL technology, which "basically brings the perfect balance in between having fewer side effects and the best spectacle independence"

The AT LARA family of EDOF lenses have become one of the mainstays in Dr. Agarwal's practice. These lenses, he said, "stay somewhere in the middle of the range of genres from monofocals to multifocals" and bring "great vision at distance and intermediate and relieves you from the tension of all the side effects existing in all higher-end premium lenses."

"This is something that is huge when it comes to patient satisfaction," he added.

"AT LARA features a diffractive optical design with 2 power additions at intermediate and far intermediate distances: This 'light bridge' optical design is balanced in a way such as to extending the depth of focus and create a continuous range of sharp vision from far to intermediate distances."

It uses ZEISS's patented smooth microphase (SMP) technology that does away with the sharp edges that cause glare and halos in older EDOF and multifocal IOL designs. The AT LARA's design also expands the range of focus beyond that of existing EDOF lenses as illustrated by its defocus curve and features a color-corrected optic design for correcting chromatic aberrations.

Dr. Agarwal and his colleagues conducted a study on the different IOLs from monofocals to multifocals that they were using in their clinic, collecting data about all the complications and reports of problems patients encountered with each type of lens. The LARA, he said, fit right in the middle of the range with all the EDOF lenses, with simpler trifocals on the other extreme.

Regarding the implantation technique, Dr. Agarwal has found the LARA has the best plate-haptic design going into the bag. "Usually with a plate-haptic design, I use more force, but with this design I'm not using as much force to push it in," he said. The result is an effortlessly well-centered lens at the end of each case.

After the eight cases he had performed by the time of the user meeting, Dr. Agarwal found that aiming for a 0.5-D myopic correction provides great distance vision, losing only a little bit of near—which he indicated was true for any EDOF lens. For more near vision according to the patient's preference, aim for a 1 D myopic shift.

"The biggest advantage to me is the lack of halos," he said. Ultimately, the AT LARA provides the widest range available of all EDOFs but with great balance between great vision and reduction in side effects."

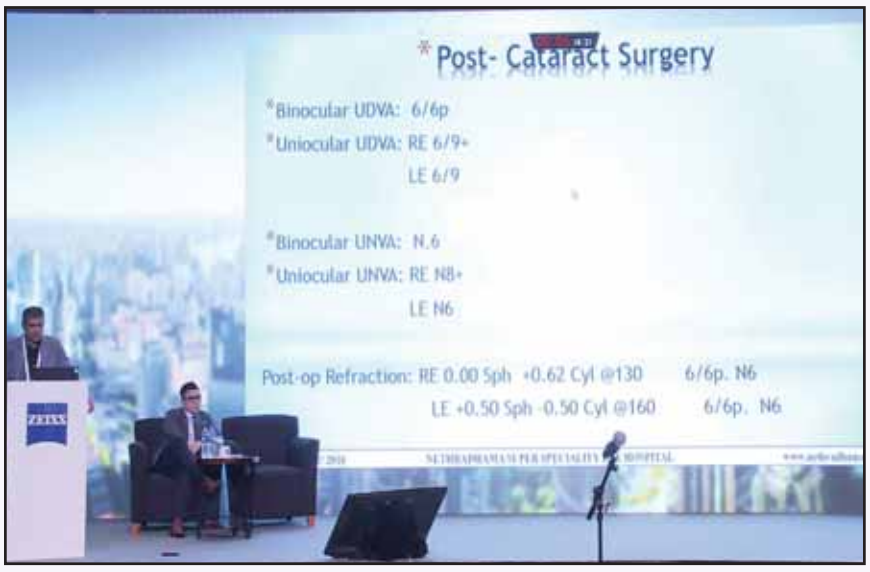

Figure 1. Results of cataract surgery with multifocal IOL implantation post-SMILE.

Source: Sri Ganesh, MD

Multifocals in post-SMILE cataract surgery

Conventional wisdom dictates that multifocal IOLs are a less than ideal choice for less-than-pristine eyes. **Sri Ganesh, MD, Bangalore, India, reported on t**heir first case of a post-SMILE patient undergoing cataract surgery and receiving a multifocal IOL implant.

The patient, a 50-year-old, underwent SMILE in 2013, when he had high myopia of –9.5 D, 0.5 D cyl in the right eye and –10 D, 0.5 D cyl in the left eye—almost at the upper limit of treatment. Post-SMILE results were very good, with the patient achieving an uncorrected visual acuity of 6/6 in each eye; however, 5 years later he experienced diminished vision and poor night vision, subjectively unable to see well at distance.

On examination, Dr. Ganesh noted grade 2 nuclear sclerosis in the right eye and grade 1 nuclear sclerosis in the left eye; an uncorrected distance visual acuity (UDVA) of 6/24 –2.75 Sph –0.75 Cyl @ 30 improving to 6/9 in the right eye, 6/12 –2.0 Sph –0.75 Cyl @ 140 improving to 6/7.5 in the left eye.

The patient posed Dr. Ganesh with a challenge—he did not want to wear glasses and specifically wanted multifocal IOLs.

Pentacam studies showed that the SMILE outcome was retained and well-centered; meanwhile, a Holladay equivalent k-reading (EKR) detail report produced a single peak showing regular distribution of Ks. Zernike analysis was "not bad for someone who had high myopia since you expect induced aberra-

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tions": Z4 –0.677 in the right eye, OS Z4 –0.532 in the left.

"Ideally you would like spherical aberration to be less than 0.5, so use a negative aspheric lens," Dr. Ganesh said.

After trying various different IOL formulas, to determine target correction, Dr. Ganesh finally decided to go with the actual measurement using the total-K values from the IOLMaster (IOLMaster 700 with Total Keratometry, ZEISS) with the Barrett Universal II formula and to implant the AT LISA TRI (ZEISS) in both eyes, +19.0 D in the right eye, +18.0 D in the left.

Postop, the patient achieved binocular UDVA of 6/6; uniocular UDVA of 6/9+ in the righteye, 6/9 in the left; binocular uncorrected near visual acuity (UNVA) of N6; uniocular UNVA of N8+ in the right eye, N6 in the left.

Postop refraction, he said, was "bang on target": 0.00 Sph +0.62 Cyl@130 6/6p, N6 in the right eye; +0.50 Sph –0.50 Cyl@160 6/6p, N6 in the left.

There was no difference, he said, between a post-SMILE patient and a post-LASIK patient; however, post-SMILE patients have fewer aberrations, with better EKR graphs especially for very high myopia correction, so post-SMILE eyes may be better suited to multifocal IOL implantation than post-LASIK eyes.

Meanwhile, true keratometry with the IOLMaster 700 may provide better or comparable refractive outcomes.

Finally, he said, ZEISS has the solution for correcting the complete range of refractive needs—correcting refractive errors with SMILE or the MEL90; correcting presbyopia with PRESBYOND; accurate measurements with the IOLMaster 700 with Total Keratometry for post-refractive surgery cases; and a large complement of IOLs.

Enhancements: Rounding out ZEISS's cataract and refractive solutions

ZEISS's cutting-edge technologies provide a number of options should a patient require enhancement after surgery.

"CIRCLE completes the armamentarium for enhancement," said **Iain Dunlop, MD**, Canberra, Australia. "Although one might only use it on very rare occasions, ZEISS has provided this solution for an enhancement that turns the SMILE procedure essentially into a LASIK procedure."

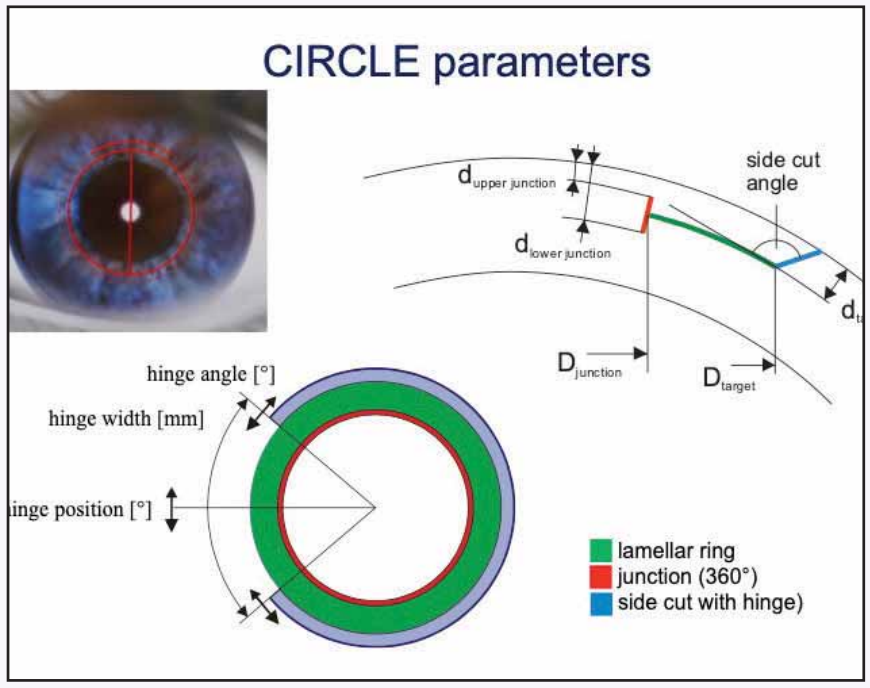

Figure 2. CIRCLE parameters.

Source: Iain Dunlapk, MD

SMILE, Dr. Dunlop said, is more robust than LASIK and theoretically creates lower dry eye states due to preservation of corneal nerves. SMILE is currently for myopia and myopic astigmatism; FLEx is half way to SMILE, still useful as a closed procedure (PseudoSMILE), and useful if enhancement is expected.

Glenn Carp, MBBCh, FC Ophth (SA), recommends performing thin-flap LASIK after SMILE (OFF Label). The thin flap creates a more superficial flap compared to CIRCLE which forces the flap to be the same depth as the original cap.

Dr Carp's standard cap thickness in SMILE is between 135 to 145 µm, which gives plenty of room to create a 100 µm flap. Dr Carp's Golden Rule is "don't operate blindly." Every femtosecond laser has a standard deviation that must be taken into account, he said. Therefore, it is essential to use OCT or VHF digital ultrasound to precisely measure the epithelial thickness and original cap thickness when planning a retreatment.

When lifting the thin LASIK flap, Dr. Carp noted that it is important for surgeons not to enter near the original SMILE incisions to decrease the chance of crossing

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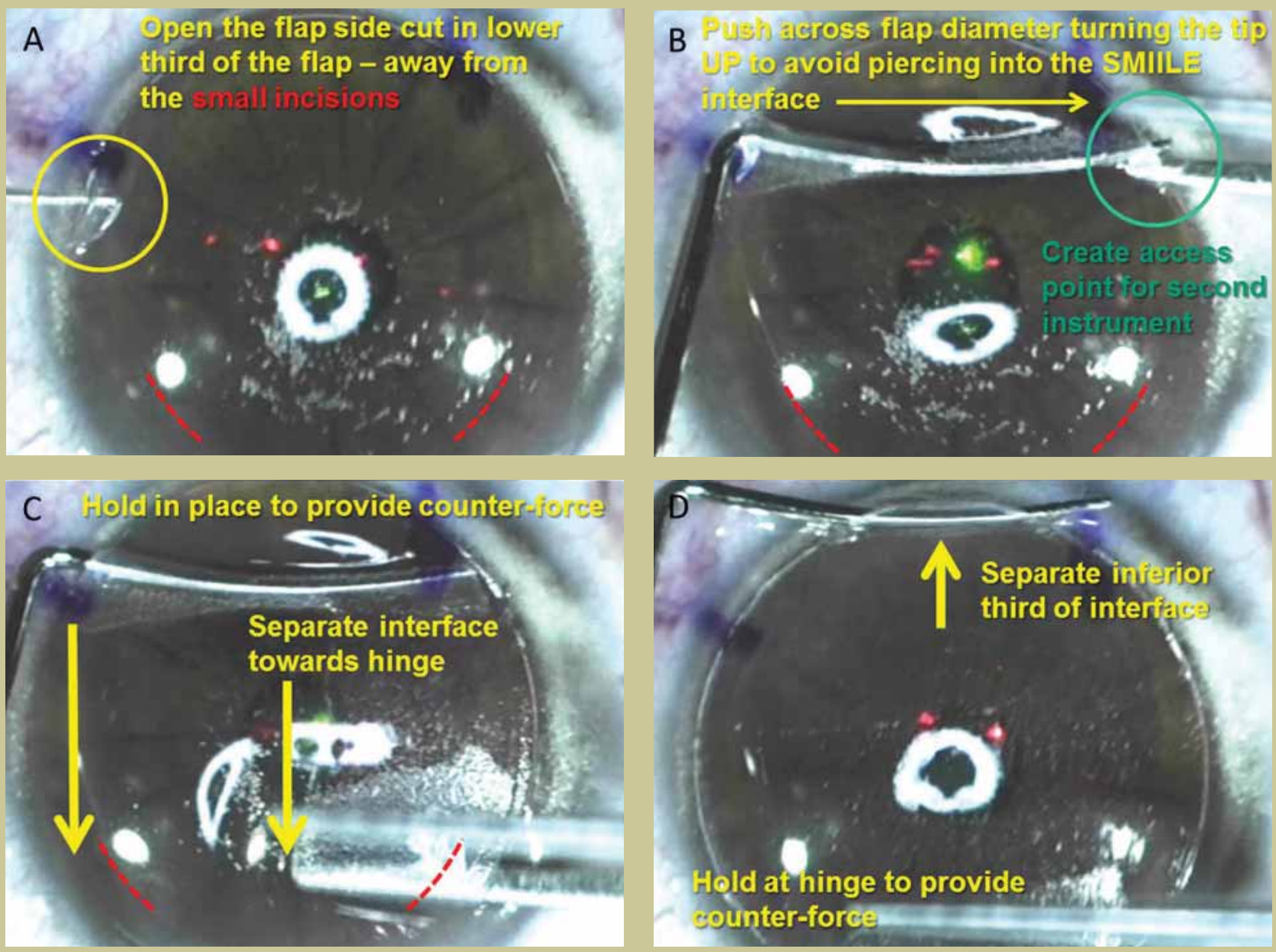

Figure 3. Pearls to a thin LASIK flap

Source: Glenn Carp, MBBCh, FC Ophth (SA)

interfaces. The best technique is to enter mid-flap (Figure 3A) and push across the diameter of the flap (Figure 3B). Once a new access point is created, the second instrument can enter and be used to separate the superior two-thirds of the flap while the other instrument is held in place as an anchor (Figure 3C). Finally, the inferior one-third of the flap can be separated (Figure 3D). It is also important to apply some upward pressure as the tip is passed across to avoid the tip breaking through to the original SMILE interface.

In the first 4,000 SMILE procedures performed at London Vision Clinic, London, UK, by Dr. Carp and Prof. Dan Reinstein, 2.5% required a retreatment. All retreatments were performed by thin-flap LASIK. An M ring was used in 93% of eyes to make sure there was enough clearance from the small incisions. Finally, Dr. Carp said that almost all of the intraoperative complications occurred prior to development of this technique. The complications were due to inadvertently accessing the original interface at the superior portion of the flap. Once the new flap-lift technique was perfected,