# Alcon at APACRS 2023:

## IOLs, Microscopes, Live Surgery, and Glaucoma Devices

At this year's APACRS 2023, Alcon hosted multiple booth talks and a live surgery lunch symposium. Here are some of the highlights.

### IOLs

Both Dr. Chee-Soon PHAIK (Singapore) and Prof. Thomas KOHNEN (Frankfurt, Germany) discussed Alcon's newest presbyopia-correcting intraocular lenses (IOLs). Dr. Phaik offered tips on patient selection for both the Clareon PanOptix and AcrySof IQ Vivity lenses, while Prof. Kohnen discussed real-world registry data on the Vivity lens and offered personal insights from his experiences with the lens.

The PanOptix is a diffractive trifocal IOL that splits light [1], resulting in an 88% light transmittance.

"This means we need to screen the eye, select perfectly normal eyes, and counsel patients carefully," Dr. Phaik said, noting that doing so results in spectacle freedom 90% of the time. [2-5] She added the importance of screening the optic nerve (not just the macula) with an optical coherence tomographer (OCT) and examining the ocular surface to ensure the patient has little inflammation and good tear film.

Dr. Phaik excludes patients who have undergone previous refractive surgery, and recommends surgeons who are just beginning to include trifocal lenses also avoid those patients.

"If you look at higher order aberrations, you want to ensure patients don't have them because of the steep defocus curve of the lens," she said (see Figure1). Finally, patients will need to be tolerant of some degree of halo and possibly mild glare. The surgeon should also consider the additional chair time needed, the need for accurate biometry, and "the need to be competent with toric correction," she said.

The Vivity lens is based on X-Wave technology that provides continuous depth of focus. The central 2.2 mm is a 1 µm plateau consisting of two smooth transition elements. The first transition element alters the wavefront stretching the light as it enters the eye from a distance and as light is stretched, it collapses on itself as it enters the eye, forming the continuous light needed for intermediate and distance vision. The second transition element is the curvature that delays and shifts the wavefront so when light passes through the lens it takes on the shape of the profile of the lens and as it collapses on itself and folds on itself, it forms the continuous light in focus for near to intermediate distance.

"Importantly, there is no splitting of light," Dr. Phaik said. "All the light that passes through the lens is stretched," making it act more like a monofocal lens. [6] Other advantages include less susceptibility to decentration and good

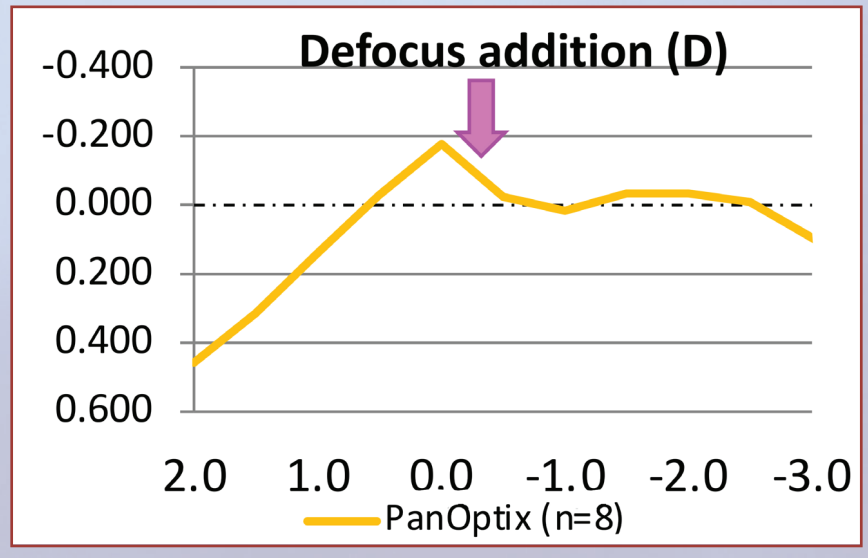


**FIGURE 1.** The PanOptix has a steep defocus curve

contrast sensitivity. Integrating the lens into her practice has been smooth — the lens is suitable for patients who desire continuous vision from distance to intermediate and functional near vision, but should also be considered for patients who may not be candidates for other advanced technology lenses because of dry eye, mild optic nerve or macular disease, or post-corneal refractive surgery. She said the Vivity lens should not be implanted in patients with a desire for prolonged close vision or in those who have severe loss of central vision.

Prof. Kohnen noted extended depth of focus (EDOF) lenses provide excellent distance vision, improved vision in the intermediate range, functional near vision, but the optical quality and phenomena depend on the lens design itself. [7]

In his first 16 patients (32 eyes) [8] with the Vivity "what was astonishing was first, we had a very nice defocus curve," he said, "and very good subjective quality of vision, even night driving." The lens produced substantially less halo than other diffractive technologies; the only detractor is "we cannot achieve near VA perfectly."

The Vivity Registry Study, a multicenter, non-comparative, open-label, non-interventional registry study [20], was designed to evaluate photopic binocular uncorrected VA at a distance after bilateral implantation with either the Vivity or Vivity toric lens between June 2020 and December 2022. The registry included 41 sites from Europe, Australia, and New Zealand and comprised 910 patients, the majority of whom were ≥ 65 years old (64.7%), female (56.3%), and white (97.6%). More than 84% of the eyes had < 0.5 D of manifest refraction at the study entry visit (after implantation of the lens). At study entry, 884/910 (97.1%) of patients had an uncorrected distance VA of 0.009±0.0998 logMAR (20/20 Snellen); all but one patient had an intermediate VA (66 cm) of 0.084 logMAR, and every patient had a near VA (40 cm) of 0.25 logMAR (about 20/25 Snellen); see Figure 2. Most patients did not need spectacles for distance, intermediate, or near in either bright (88.2%, 78.2%, 48.3%, respectively) or dim conditions (85.2%, 68.3%, 31%, respectively). Further, of the patients who responded to the Catquest-9SF


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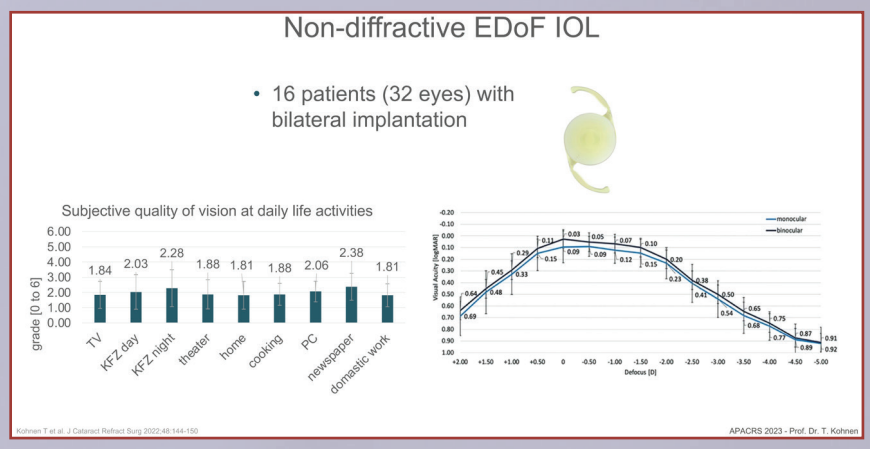


**FIGURE 2.** Prof. Kohnen's initial outcomes with the Vivity lens

questionnaire, 853/879 patients (97%) reported no or some difficulty with their sight for activities of everyday life, and 91.4% were satisfied with their sight.

"More than 91% of patients also reported no halos, glare, or starburst," Prof. Kohnen said. Complications were also low, with < 5% that needed posterior capsulotomy in either eye.

Of the 321 patients in the registry who were implanted with at least one toric lens, outcomes were similar to those who did not need a toric lens, Prof. Kohnen said. The mean uncorrected distance VA for the toric patients was 0.016±0.105 logMAR (about 20/20 Snellen). Most patients did not need spectacles for distance, intermediate, or near in either bright (87.1%, 76.3%, 46.6%, respectively) or dim conditions (85.2%, 65.7%, 30.4%, respectively). Of the 311 patients who answered the Catquest-95F questionnaire, 284 (91.3%) were satisfied with their vision. More than 90% of toric patients reported no visual disturbance.

Outcomes were similar in the mini-monovision group (n=202) and the post-corneal refractive surgery group (n=26), where uncorrected and corrected VA at study entry was about 20/20 Snellen, most patients did not need spectacles in either bright or dim conditions, and 90% and 88%, respectively, reported no visual disturbance. Outcomes were also similar for patients with dry eye (n=85), glaucoma (n=35), or age-related macular degeneration (n=42), with binocular vision at about 20/20 Snellen, most patients did not need spectacles in either bright or dim conditions, and more than 89%, 91%, and 88%, respectively, reported no visual disturbance.

## Microscopes and Surgical Management Systems

Dr. Anurag MISHRA (Cuttack, India) said Alcon's LuxOR Revalia microscope has three types of LED illumination, including warm white, cool white, and mixed white. There are three sources for the illumination, one for coaxial and two for oblique.

"Coaxial illumination is ideal for helping you see reflective, mirror-like objects, whereas the oblique illumination helps you to see the transparent and the semi-transparent objects like the cornea or posterior capsule," he said. The Revalia boasts a 6-times larger, more stable red reflex than other microscopes,[9] and provides a 33% greater depth of focus compared to conventional microscopes.

The microscope places the objective lens above the light source, which produces a divergent coaxial illumination, he explained.

"What you lose out on if you use coaxial illumination to the brightest extent possible is that the depth of focus reduces," he said. "When the light is coming to the patient's eye, it is not being focused by the objective lens, which means that it is more comfortable to the patient, but also for the surgeon since our eyes also tire out after 20-30 surgeries if the illumination is too bright."

Because the objective lens is placed above the illumination, the Revalia provides 65 mm buffer, meaning surgeons can focus on the cornea and the microscope will provide a view back up to the posterior capsule.

The Revalia also has additional features such as two screens, a swivel arm, magnetic clutch handles, foot pedal adjustments, and an inbuilt recorder. Dr. Mishra said the microscope has improved his surgical outcomes, by providing better visibility, reduced complications, and the ability to perform more surgeries in a shorter amount of time. He has come to rely on the microscope in more challenging cases, such as hard cataracts, deep sockets, eyes with weak zonules, nystagmus, among others. "What has improved in my practice is that perhaps I am a much more artistic surgeon," he said.

Dr. David LUBECK (United States) said Alcon's ARGOS provides faster and more accurate biometric and anatomic measurements even through dense cataracts; robust surgical planning; intraoperative data transfer, integration and guidance; and outcomes analysis and nomogram optimization. [10-15]

"I'm reluctant to call it a biometer because ARGOS is a surgical management system. It does so much more than just biometry that we're doing it a disservice by calling it a biometer," Dr. Lubeck said. "We're also doing ourselves a disservice by looking at a device with such immense capabilities and limiting it to just making a few measurements." Among the advantages the ARGOS offers, Dr. Lubeck said, is the "huge amount" of information available in the analysis mode, complete with adjustability at each step of the procedure. "In less than a second, the ARGOS is capturing axial length, anterior chamber depth, keratometry, corneal diameter, central corneal thickness, aqueous depth, pupil size, lens thickness, limbal registration, visual axis, and pupil centration," he said.

The system uses swept-source optical coherence tomography (OCT), which means that at 20 dB, ARGOS is 100 times more sensitive than the coherence interferometers of other devices. Dr. Lubeck added a valuable component is the enhanced retinal visualization (ERV) mode, "which amplifies the signal 10 times, allowing the device to measure through cataracts of all grades, including grade 4 nuclear and cortical cataracts. The result is that this machine has a 41% higher acquisition rate in grade 4 cataracts than the IOLMaster 700 (Carl Zeiss Meditec) [12]," he said. That, in turn, means an 83% reduction in the need for A-scans. [12]

"ARGOS measures each segment of the eye, applies the index of refraction of the cornea or the aqueous or the lens, and then calculates the precise axial length of the overall length by compounding those numbers," he said. Speed of acquisition is also quicker with the ARGOS than the IOLMaster 700 — 50% faster, [12] in fact, and ARGOS also has a faster acquisition speed than the IOLMaster 500, [13] Dr. Lubeck said.

The OCT guidance helps the clinic technicians take more accurate measurements, as ARGOS can detect small degrees of lateral eye movement (technicians can see real-time correction of their eye alignment); vitreous anomalies may be visible (technicians can check the boundaries of the OCT to ensure the anomaly is not mistaken for a boundary). Perhaps one of the best time savers for

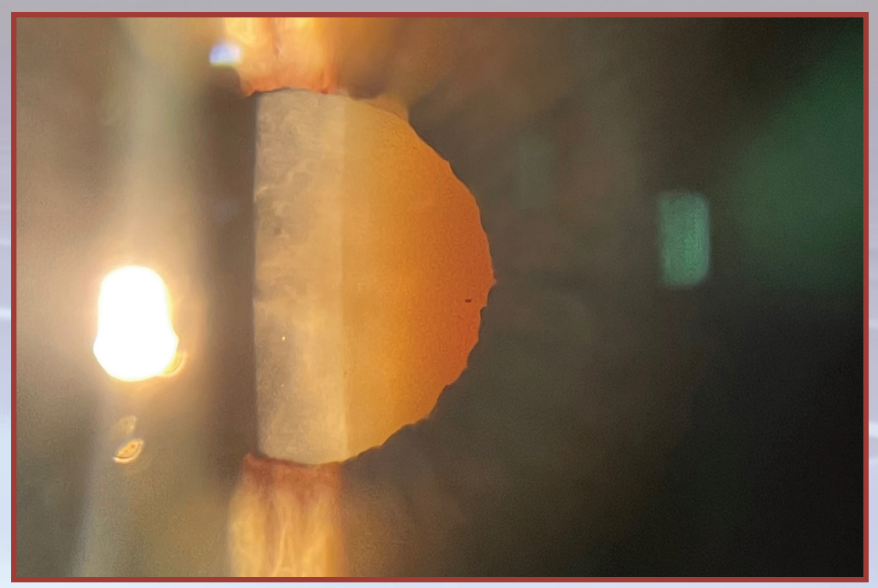

**FIGURE 3.** The ARGOS in Enhanced Retinal Visualization Mode

**To view the video from Alcon's Live Surgery Event at APACRS 2023, please scan QR code shown here.**

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technicians is that if the view of the retina is blurred and the first measurement is difficult, the technician knows not to spend time constantly re-capturing and to move directly to the ERV mode.
Once the measurements are done, a "single click" sends the biometry information to the surgical planner that already has surgeons' preferred lenses, preferred formulas, surgically induced astigmatism incision placement, etc., "so with minimal effort, you can choose your lens in Alcon's Vision Planner and not even need paper if you're digitally inclined," Dr. Lubeck said. The system currently uses multiple IOL formulas, including the updated Barrett Suite. [12]
For post-refractive surgery cases, the Vision Planner allows manual entry of the posterior keratometry data and use of the Barrett Total K formula.
"I'm achieving over 90% accuracy in all patients," Dr. Lubeck said, "but especially in the post-refractive surgery cases." Busy surgeons can also take advantage of the remote Vision Planner software, which Dr. Lubeck has started to use in hotels, at home, among other locations. For surgeons who use the Alcon's LenSx laser, ARGOS provides image-guided integration to the Alcon cataract refractive suite, reducing the risk of transcription errors, accurately accounting for cyclotorsion, reducing the variability from manual marking, and enhancing surgical precision and refractive outcomes.

"Anatomic or pupil center may be acceptable for routine cases, but I believe for presbyopia-correcting lenses, we will aim towards centering on the patient's visual axis," he said. Finally, he said for those who use Alcon's ORA intraoperative biometer, "the difference now between the ARGOS predicted outcomes and the ORA predicted outcomes has become much, much, much smaller. I'm a big fan of both technologies."
Dr. Lubeck told attendees the ARGOS "is something which is going to have an overarching impact on our current and future ability to accept and integrate new technologies, new lenses, new technologies in surgery, and will provide better outcomes and less surgeon stress, less surgeon fatigue, and more room to think broadly and widely and create new things."

## Live Surgery

For the first time since the global pandemic, luncheon attendees were treated to a live surgery demonstration, incorporating all of the above technologies and devices. Dr. Gavin TAN (Singapore) demonstrated the use of the Alcon LuxOR Revalia microscope, the Centurion phaco machine with ACTIVE SENTRY, and the new Monarch IV injector for the Clareon PanOptix toric lens.

Dr. Ronald YEOH (Singapore) discussed the Alcon Vision Suite, "a suite of products ranging from the acquisition of data and biometry typified by VERION and the new ARGOS system to the LuxOR Revalia microscope, the Centurion phaco machine with ACTIVE SENTRY and the full range of IOLs." The Revalia marks Alcon's first venture into the field of optical microscopes, he said, and it succeeds by offering "better visualization and the largest depth of field."

In his opinion, "the most useful feature" of the microscope is its larger and more stable red reflex, a point reiterated while Dr. Tan performed the surgery. From the surgeon's perspective, Dr. Yeoh said that because the microscope's light is non-focused, "our maculas can tolerate a longer period of exposure to the LuxOR microscope compared to some of the competition."
The ACTIVE SENTRY component of the Centurion allows surgeons to operate at normal to low IOPs, low surge, and full control of the chamber fluctuation, Dr. Yeoh said.

"That's largely due to the presence of the sensor in the handpiece, which allows a more rapid response time, resulting in reduced occlusion break surge," he explained.

In the Asia-Pacific region, the latest IOL is now the PanOptix toric on the Clareon platform, "which will be glistening-free," Dr. Yeoh said, and includes a new handpiece delivery system, the Monarch IV. "While you'll have all the inherent benefits of the PanOptix, we're now hearing patients are getting better contrast sensitivity as well."

Dr. Tan's patient was a 54-year-old Chinese female who presented with a moderately dense nuclear sclerosis; Dr. Tan planned on implantation with an Alcon Clareon PanOptix toric lens. As he started the surgery, he said the VERION "can help you ensure the capsulorhexis is well centered." As attendees watched the eye moving left and right, up and down, Dr. Tan pointed out the consistently "very, very good red reflex." He recommends using ProVisc (Alcon) viscoelastic as it's "much easier to remove and reduces rotation when you're putting in toric IOLs."

Because the Clareon material is a "bit softer" than the AcrySof, surgeons should use the Monarch IV injector for implantation.

Once the surgery was completed, Dr. Michael LAWLESS (Australia) talked about lens choice, noting that Alcon has eight different IOLs in powers from +6D to +40D, with five toric lenses ranging from T2 to T9.

In clinical studies on the PanOptix, "more than 96% of the 109 patients reported never needed glasses)." [2-5]
With the Vivity lens, "you get a monofocal type profile in terms of visual disturbances; the Vivity registry study showed 91% of subjects report no visual disturbances."

In his own practice — which performs 19,000 surgeries per year across all surgeons — the use of EDOF IOLs has steadily increased from 2020 to 2023, now comprising almost 14% of lens implantations, while the use of trifocal IOLs has decreased slightly in that time, from 25% to 20.5%, as has the use of monofocal IOLs, from 69% to 66%. In his own hands (he performs about 400 surgeries per year), "Vivity has quickly come to take up around 65% to 70% of the lenses I use," he said. "It's my default lens. I have to find a reason NOT to use it."

"The trend inexorably is to presbyopia-correcting lenses," he said. "Not using them now is starting to be unusual in Australia. The Vivity lens is a good entry point, and whether you use the Vivity or the PanOptix trifocal lenses will likely be determined by your own personality, your risk profile, and your patient base."
Panelists Dr. Allan FONG (Singapore) and Dr. Lubeck weighed in; Dr. Fong said his use of the Vivity is about 30% to 40% and his multifocal use is about 20% to 30%. Dr. Lubeck said his use of the Vivity is mostly in patients "who were initially inclined toward a monofocal toric; stepping up to the Vivity toric adds a significant advantage for them with really no downside."

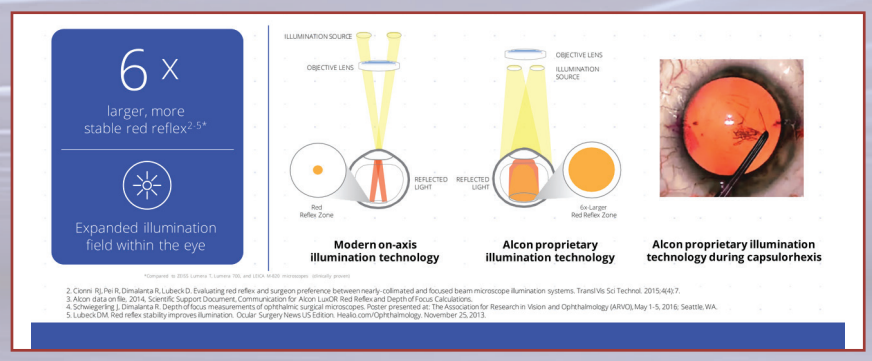


**Figure 4.** The LuxOR Revalia uses proprietary illumination technology

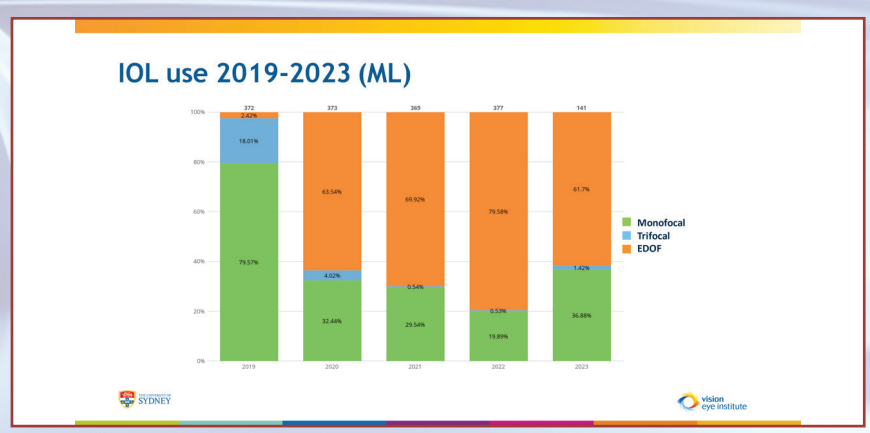


**Figure 5.** Dr. Lawless' trends from 2019 to 2023 show increasing use of EDOF lenses.

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## Glaucoma

The advantages of minimally invasive glaucoma surgery (MIGS) include that it is a micro-invasive approach that inflicts minimal trauma to tissues while providing both a rapid recovery and a higher safety profile than traditional invasive surgery, said Dr. Bryan ANG (Singapore). While there are numerous devices that fall under the MIGS category, Dr. Ang said there are about 53 million people worldwide with glaucoma, "and that's why MIGS are so important. We know that most of the patients fall under the mild to moderate category of glaucoma, and about 25% of them have moderate to severe disease."

The Hydrus Microstent, a flexible microstent made of nitinol (the same material used in cardiovascular stents) that is used to enhance the outflow of aqueous from the anterior chamber through the Schlemm's canal, is indicated for use in conjunction with cataract surgery for the reduction of intraocular pressure (IOP). Studies have shown devices using the conventional outflow through Schlemm's canal have a more favorable safety profile than bypass devices that use the suprachoroidal or subconjunctival space. [16]

"More than 100,000 eyes have been implanted with the HYDRUS. and there have been no reported cases of chronic redness, irritation or intraocular inflammation attributable to an allergic reaction or intolerance to the nitinol material," Dr. Ang said. The trimodal device (1) bypasses the trabecular meshwork through the inlet of the device to allow fluid to pass from the anterior chamber into Schlemm's canal, (2) dilates and scaffolds Schlemm's canal, allowing a permanent scaffold in the canal to augment flow, and (3) is the only MIGS implant that spans 90 degrees of the canal.

The HORIZON study remains the largest of the MIGS pivotal trials (38 sites/9 countries, N=556), comparing the combination of cataract surgery (phaco) and Hydrus implantation (n=369) to phaco alone (n=187). Inclusion criteria was mild/moderate primary open-angle glaucoma (POAG), on 1-4 medications, with no prior glaucoma surgery, although selective laser trabeculoplasty was allowed. There were no statistically significant differences between the two groups at baseline; washed out diurnal IOP was 25.5±3.0 mmHg in the Hydrus group and 25.4±2.9 mmHg in the phaco-only group. The primary endpoint was the percentage of patients who achieved a ≥20% IOP reduction at the end of 2 years.

"HORIZON found 78% in the Hydrus group and 60% in the phaco-only group met the primary endpoint," Dr. Ang said, which was statistically significant ($p<0.001$). [17] Further, the Hydrus group showed an absolute reduction of -7.6 mmHg compared to only -5.3 mmHg in the phaco-only group ($p<0.001$).[17]
Of equal importance, "almost 80% of eyes in the Hydrus group got off medications and stayed off medications up to 24 months after surgery compared to less than 50% in the phaco-only group," Dr. Ang said. In his practice, where a good majority of patients are only on one medication, he said if those patients met the inclusion criteria for HORIZON, "you could confidently tell patients that almost 90% would be able to get off medications and stay off them for at least 2 years," he said. At 5 years, 66% of the overall patients in the Hydrus group remained medication-free, and 72% of those who were only on one medication at baseline remained medication-free. [18]

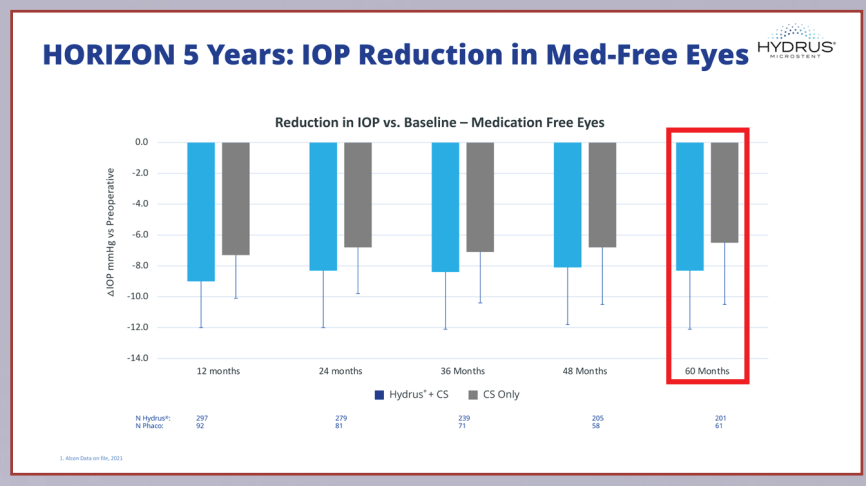


**FIGURE 6**. HORIZON Study 5-Year IOP reduction in eyes remaining medication-free

Additionally, fewer than 1% of patients in the Hydrus group had an IOP spike after surgery (compared to 3% in the phaco-only group), and there was no hypotony (≤ 6 mmHg for ≥ 1 day) reported in either group. At 5 years, 5.3% of those in the phaco-only group needed a secondary surgery (trabeculectomy, tube shunt, gel stent, etc.), which was halved to only 2.4% for those in the Hydrus group. [18]

"I think it's no surprise that the AAO's Preferred Practice Pattern POAG guidelines [19] granted the Hydrus a 'moderate quality, strong recommendation,' the highest rating of any MIGS to date," Dr. Ang said.

Other surgical pearls: ensure the gonioscope and the patient's head are tilted about 30-40º so landmarks are highly visible, use the gonio lens over viscoelastic, ensure an en face view of the angle rather than a top-down view, tilt the cannula about 15-20 º anteriorly toward the cornea at the juncture between pigmented and non-pigmented trabecular meshwork.

The Hydrus should appear "dull" during advancement and stay behind the trabecular meshwork; it it appears "shiny," the stent is in front of the trabecular meshwork and not in Schlemm's canal, he said. Postoperatively, he prescribes a tapering dose of steroids and antibiotics and halts all glaucoma medications, with exceptions for patients with severe glaucoma or who have a heavy glaucoma medication burden.

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