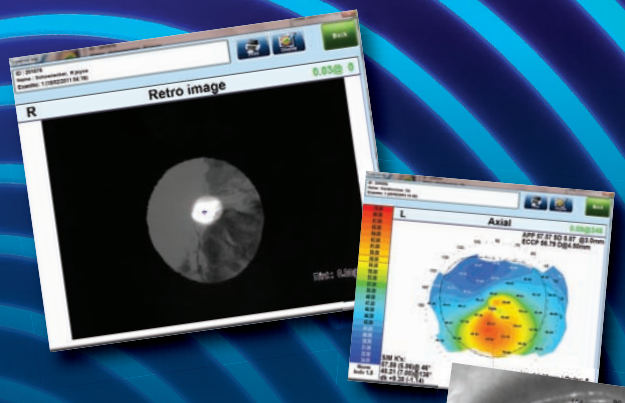
SEPTEMBER 2011

Ophthalmology MANAGEMENT®



Evaluate Your Patient's Total Visual System With the OPD-Scan III

- New features benefit you and your patients
- Complete data for IOL selection
- Assists in providing nearly perfect refractive cataract surgery results

An Instrument for All Surgeons

The new features of the OPD–Scan III will be a valuable asset to your armamentarium.

Some say lightning doesn't strike twice, but in the case of Marco's OPD-Scan III, lightning has struck three times. I've been enthralled with my OPD II (3D Wave) for several years — it's my favorite piece of diagnostic equipment — so I didn't feel there was much to improve upon, but Marco has proven me wrong. With the OPD-Scan III, Marco didn't simply release a new software update with a new screen. The manufacturer and engineer, Nidek, actually took a clean slate approach and reworked the diagnostic machine from the chassis on up.

Giving Doctors What They Want

The OPD-Scan III continues the tradition of being an excellent multifunctional ophthalmic device. It combines a corneal topographer, autorefractor, wavefront refractor, wavefront analyzer, internal optical path difference analyzer (OPD) and light/dark pupillometer. In addition, the OPD-Scan III has the ability to record retro-illumination images, provide a toric IOL summary, calculate the effective central corneal power in postrefractive patients, calculate the modular transfer function of the optical system and provide a visual acuity simulation of corrected and uncorrected vision. These capabilities help fill out the spectrum of diagnostic tests that refractive cataract surgeons need and want.

Starting with corneal topography, they almost doubled the number of acquired data points from 6840 with the 3D Wave to 11,880 with the OPD-Scan III. This was aided by expanding the placido disc from 19 rings with the 3D Wave to 33 rings with the OPD-Scan III (**Figure 1**). By increasing the number of rings, the density of data points in the central cornea has increased significantly, which allows for more precise data in the area of the cornea that are most affected by postrefractive surgery and most crucial in IOL calculations. The addition of this extra data hasn't slowed down the acquisition process. Actually, the process to obtain a complete scan has been cut in half — from 20 seconds to 10. Some of this improvement stems from the fact that the placido disc has been changed from red light rings to blue light rings, which are less startling to patients. If there's less startle, blink errors are reduced.

The 3D Wave had an infrared camera that allowed the user to help align the unit with the eye. It was easy to visualize

Figure 1. The OPD-Scan III has 33 rings for 11,880 data points. The blue light topography is much easier on patients during measurement.

pathology on the cornea, iris or lens. The OPD-Scan III has taken this ability and expanded on it, allowing the user to record and print this information. The increase in managed care and the use of medical advisory boards has made this data more crucial to obtain and save. This documentation of cortical or posterior subcapsular cataracts or posterior capsular opacification may make the difference between an approved surgical procedure or a denied claim. In addition, some medical carriers will reimburse for this photography under the external ocular photography CPT code.

Additional Features

The OPD-Scan III has taken infrared photography one step further by integrating it with the corneal topographer, providing a highly functional toric IOL summary. Most surgeons enter the preop data into the appropriate toric IOL calculator and take the printout to surgery. While in the preop area, the patient is then crudely marked with ink on the limbus. While this method works for the most part, the ink often spreads over a 5° axis or there may be unaccounted cyclorotation. The OPD-Scan III allows surgeons to obtain an

By Farrell "Toby" Tyson, MD, FACS

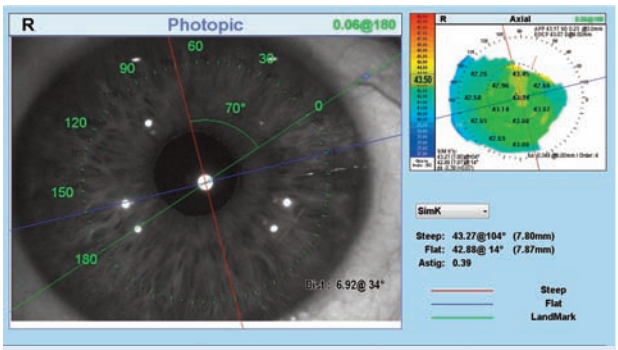


Figure 2. The toric IOL Summary allows you to accurately mark cornea based on landmarks, such as vessels, iris crypts or iris nevi.

infrared image of the eye in a dilated or undilated state, illuminates the blood vessel on the sclera for landmarking, then superimposes the keratometric astigmatism and the surgical toric IOL placement over the image (**Figure 2**). This method eliminates the time-consuming process of marking patients on the surgical day and allows placement based on anatomical landmarks such as vessels, iris crypts and iris nevi. Postoperatively, this same process can be used to evaluate the surgical outcome or determine if rotation has occurred over time.

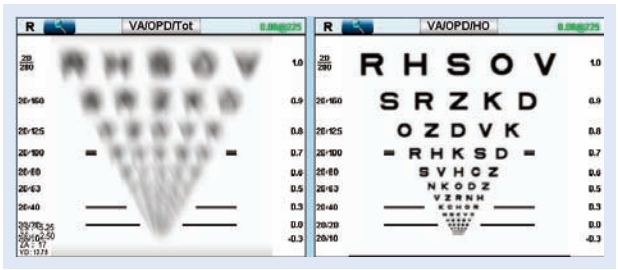


Figure 3. The visual acuity display on the OPD-Scan III provides comparative images with and without higher-and/or lower-order aberration corrections.

Catch the Wavefront

The wavefront analysis function of the OPD platform has been very beneficial to refractive cataract surgeons because of its ability to calculate corneal spherical aberration. This helps guide the proper IOL selection based on the spherical aberration correction of the IOL. This is important in working toward the goal of leaving the post-cataract surgery patient with as little total spherical aberration as possible, allowing for maximal contrast sensitivity, which is extremely important for the highly demanding diffractive multifocal IOL patients and post-refractive cataract patients. In an effort to present more data for the surgeon, the OPD-Scan III has allowed the acquisition of wavefront data over a 9.5-mm area as compared to the 6.0-mm area of the 3D Wave. This increased area provides information where blend zones and treatment edges of LASIK take place.

A wavefront analyzer helps us understand the mysteries of refractions. In the past, all we had were topographers and autorefractors. On occasion, we see a patient without pathology whose vision doesnít significantly improve with refraction. Usually, at this point, your autorefractor is over-cycling and maybe your corneal topographer is displaying asymmetric astigmatism. This is usually a clue that something more than lower-order aberrations are at play. The OPD-Scan III does a great job of presenting the higher-order aberrations in a multitude of displays. Explaining higher-order aberrations to patients is easier with the OPD-Scan III, because it has the ability to show comparative images with and without higher- and/or lower-order aberration corrections (**Figure 3**). This visual presentation greatly simplifies the discussion with patients, so more time can be spent on the discussion of treatment options.

As time marches on, more and more of our cataract surgery patients will also be post-refractive surgery patients. The alterations to the cornea present many problems to the surgeon — from IOL surprise to induced spherical aberration. Many patients inform the surgeon that they've had previous LASIK surgery, but they have no documentation — many don't even know if they had a myopic or hyperopic correction. This is easily elucidated with corneal topography, but the IOL calculations can still be tricky as effective lens position is altered by the alteration in corneal keratometry values. In order to obtain more accurate results, several different methods have been developed to help select the appropriate post-refractive IOL. The OPD-Scan III is able to calculate the effective central corneal power (ECCP) to provide a K-reading for IOL calculations. The software takes the 3 mm and 4.5 mm corneal power centered over the pupil from the corneal topography and compares it to the periphery, around a 9 mm zone. This information allows the software to calculate what the central corneal curvature power would have been before the myopic ablation and can modify it to compensate for the posterior radius of the cornea. With these values, the software computes the new ECCP.

These modifications and improvements have taken a very robust device and made it even more useful in a more complex ocular surgical environment. We no longer need to fear the postrefractive patient. Toric IOLs will require less intervention with greater reproducibility. Monofocal patients can benefit from spherical aberration optimization. Even standard eye exams benefit from the OPD-Scan III and its ability to highlight wavefront aberrations that limit the effectiveness of spectacles. This one device has become the gateway to our clinic.

Dr. Tyson is a refractive cataract/glaucoma eye surgeon at the Cape Coral Eye Center in Florida. He may be reached at tysonfc@hotmail.com.

Pursuit of Perfection

How the OPD–Scan III assists me in providing nearly perfect refractive cataract surgery results.

Refractive cataract surgery is a growing field. For surgeons looking to tap into this market, management of astigmatism is the first step. An estimated one quarter of all patients over the age of 40 manifest significant astigmatism,[1,2] while nearly 20% of cataract patients have more than 1.5 diopters of preoperative corneal astigmatism.[3]

Accurate Meridian Measuring

Several approaches can be implemented to reduce cylinder at the time of cataract removal. Regardless of your surgical preference, identification of the steep corneal meridian is imperative. By most accounts, available toric IOLs demonstrate remarkable rotational stability, with nearly 100% of lenses falling within 10° of the intended orientation (**Figure 1**).[4,5] Therefore, when there is postoperative residual astigmatism, I've always suspected there was an inherent problem with the precise identification of the steep meridian.

Proposed methods for accurate meridian recognition include placement of preoperative reference marks, usually at the surgical limbus, at the 3- and 9- o'clock positions (some surgeons include the 6- o'clock position), while the patient is upright to reduce the effect of cyclotorsional rotation. Subsequent marks are then placed at the steep keratometric meridian, either at the surgical limbus or the peripheral cornea. Alternatively, distinct emissary vessels or other easily identifiable anatomic landmarks can be used as axis markers. Recently, a modification of this method has been applied using a photograph and subsequent triangulation of preplaced reference marks.[6] However, this adds a considerable level of complexity to the preoperative analysis.

OPD-Scan III Benefits

I recently instituted a rapid and reproducible method of identifying the correct placement of limbal relaxing incisions or toric intraocular lenses using the OPD-Scan III. OPD stands for optical path difference. An earlier version, the OPD II (3D Wave), was an indispensable diagnostic tool in my clinic for more than 5 years. Following software and hardware upgrades, the combined skiascopic-wavescan topographer, autorefractor and pupillometer, is now capable of both flash and infrared photography.

The placido flash image (**Figure 2**), captures the Purkinje-Sanson reflex and provides a high contrast photograph of the surgical limbus. This enables identification of emissary or limbal vessels for traditional anatomic documentation. A retro-illuminated image of the crystalline lens can also be captured through a dilated pupil. I consider this photograph to be most valuable. By exploiting easily recognizable lenticular characteristics, preoperative placement of horizontal reference marks becomes obsolete.

The preregistered Toric Summary, another software upgrade, allows identification of the steep meridian. The

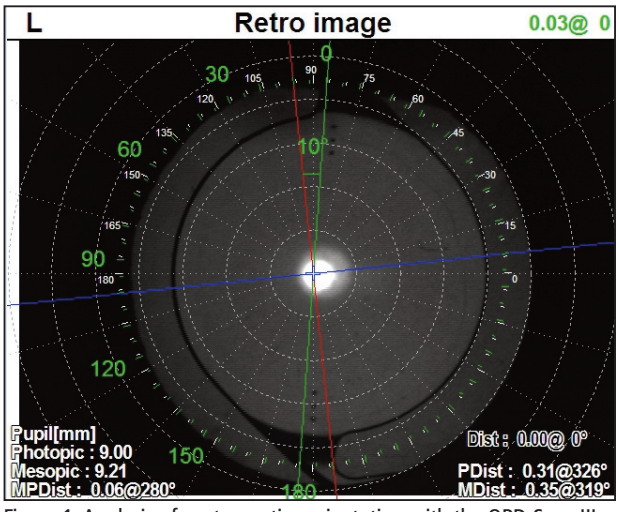


Figure 1. Analysis of postoperative orientation with the OPD-Scan III Toric Summary.

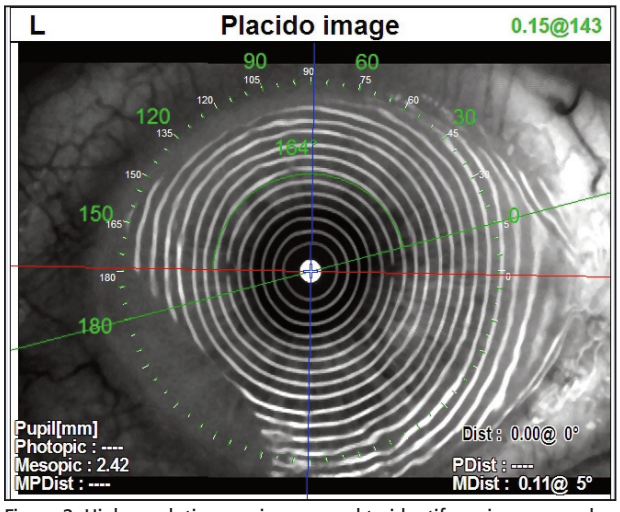


Figure 2. High-resolution eye image used to identify emissary vessels at the time of traditional axis location.

By Jonathan D. Solomon, MD

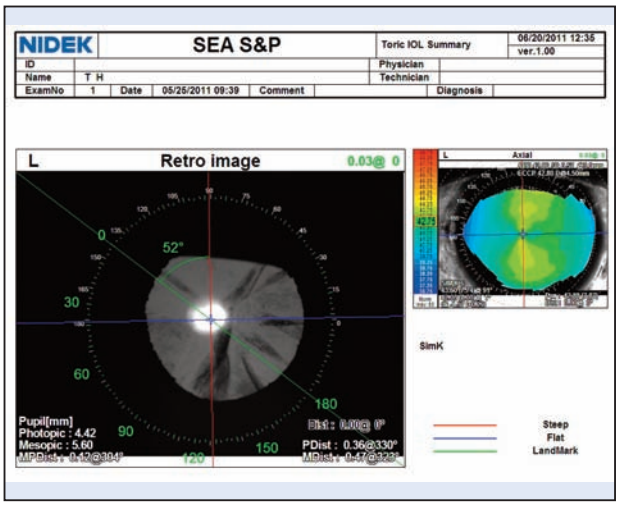


Figure 3. Toric Summary demonstrating lenticular landmarks used as reference marks, and the location of the steep meridian is then measured in degrees. The photopic eye image complete with axial topographic overlay verifies the steep axis.

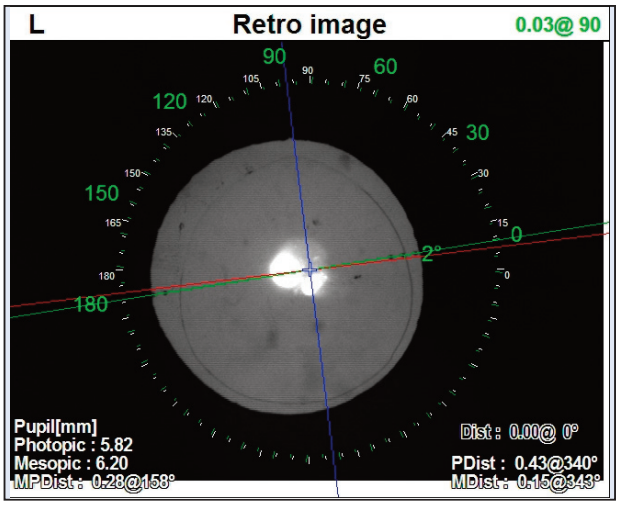


Figure 4. Toric Summary-Orientation of an Alcon AcrySof toric IOL in relation to steep meridian.

distance from the lenticular landmarks are then measured in degrees. As part of the Toric Summary, there is a photopic eye image complete with topographic overlay (**Figure 3**). The combination of the two maps virtually eliminates the chance of cyclotortional marking error. When seated at the operating scope, I merely align the steep meridian by locating the lenticular reference marks and use my favorite toric marker for orientation.

I am always trying to improve my accuracy, and when emmetropia is the goal I am within one half a diopter 89% of the time. The same precision is mandatory when correcting astigmatism. Prior to the introduction of the OPD-Scan III, 95% of my toric lenses were within 5° of the intended axis. Since we have made the change, I have reduced the axis-error and, in effect, my enhancement rate by 50%.

Nevertheless, some cases still require enhancements. Because I routinely operate on-axis, the need for vector analysis is rarely a problem as it relates to surgically induced astigmatism.

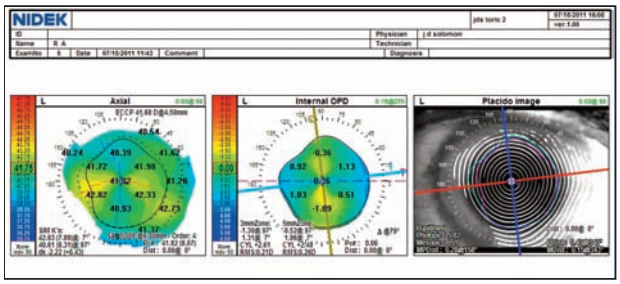


Figure 5. Comparison of the axial topography to the internal OPD. Notice the neutralization of the astigmatism.

In my hands, when intraoperative aberrometry is performed, on-axis incisions have a tendency to cause the steep meridian to slide a few degrees during aphakic or pseudophakic measurements, presumably due to stromal edema. I therefore again rely on the OPD-Scan III to analyze the position of the IOL postoperatively, and prior to enhancement. Returning to the Toric Summary, the retro-illuminated image of a dilated pupil unequivocally identifies the axis of the IOL (**Figure 4**).

Suppose the pupil dilates poorly. The OPD-Scan III is particularly effective. When the corneal wavefront profile is subtracted from the total ocular wavefront analysis, the end result is another very important derivation — the internal OPD. Complete with axis and magnitude, I'm able to easily identify the orientation of the IOL (**Figure 5**). The separation of the corneal and lenticular astigmatism is particularly useful for those who choose to operate off-axis. There's no more guessing. Vector analysis is a precise endeavor.

The backbone of the lifestyle IOL market is the toric lens, and the advanced imaging and data sets obtained using the OPD-Scan III provide a wealth of information that enable me to optimize my refractive outcomes, and in turn, grow my premium IOL practice.

References

1. Young G, Sulley A, Hunt C. Prevalence of astigmatism in relation to soft contact lens fitting. *Eye Contact Lens* 2011;37(1)20-25.
2. Bourne RR, Dineen BP, Ali SM, Noorul Huq DM, Johnson GJ. Prevalence of refractive error in Bangladeshi adults: results of the National Blindness and Low Vision Survey of Bangladesh. *Ophthalmology* 2004;11(6):1150-1160.
3. Hoffer KJ. Biometry of 7,500 cataractous eyes. Am J Opthalmol. 1980;90(3):360-368.
4. Ahmed IK, Rocha G, Slomovic AR, Climenhaga H, Gohill J, Gregoire A, Ma J. Visual function and patient experience after bilateral implantation of toric intraocular lenses. *J Cataract Refract Surg* 2010;36(4):609-616.
5. Mendicute J, Irigoyen C, Ruiz M, Illarramendi I, Ferrer-Blasco T, Montes-Mico R. Toric intraocular lens versus opposite clear corneal incisions to correct astigmatism in eyes having cataract surgery. *J Cataract Refract Surg* 2009;35(3):451-458.
6. Cha D, Kang SY, Kim SH, Song JS, Kim HM. New axis-marking method for a toric intraocular lens: mapping method. *J Refract Surg* 2011;27(5):375-379.

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Complete Data for Choosing IOLs

The OPD–SCAN III collects and displays key data in minutes for fast, accurate decisions.

In addition to refraction, we evaluate several complex factors when selecting an IOL. The OPD-Scan III, which combines an autorefractor, keratometer, pupillometer, corneal topographer and wavefront aberrometer, has multiple maps that help me select the best IOL for my patients. When I look at the printout alongside the axial length from an IOLMaster (Zeiss) or Lenstar (Haag-Streit), I can choose the optimal lens in less than a minute. And the patient experience is so fast, they hardly have time to blink.

Help Selecting IOLs

To achieve the best outcomes, we must choose the most appropriate lens for each patient. All patients have high expectations for cataract surgery, and those who are spending their own money on premium IOLs will demand the best. The OPD-Scan III excels at supplying three key pieces of information that help me choose the best IOL:

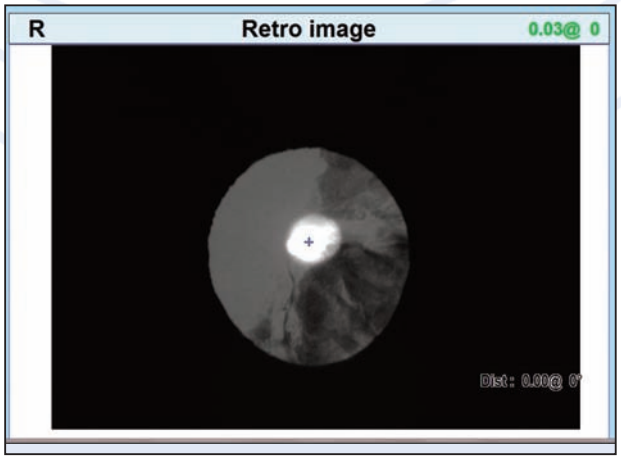

Figure 1. The cataract is visible in this retro-illumination image.

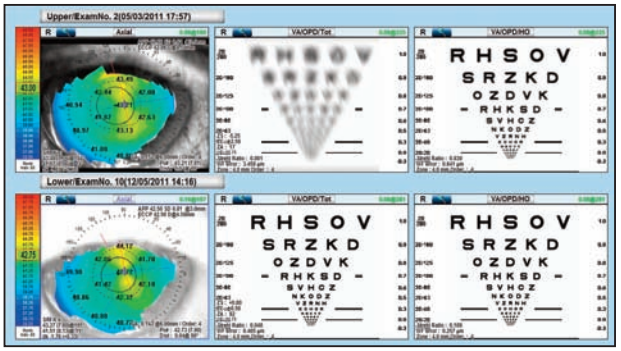

Figure 2. This side-by-side comparison shows the axial map and visual acuity before and after implantation of a toric IOL.

Angle kappa. The eye image shows me the angle kappa in millimeters and degrees. If patients have high angle kappa (my cut-off is greater than .4 mm), then a multifocal IOL may induce more aberrations, glare and halo. In my opinion, patients with a higher angle kappa who want presbyopia correction should receive an aspheric Crystalens AO (Bausch + Lomb) or a monovision setup, including an astigmatic toric lens if they have astigmatism.

Pupil size. The OPD-Scan III displays mesopic and photopic pupil sizes, both of which are key when choosing a multifocal IOL. When I compare the enlarged pupil in dim illumination versus the contracted pupil in bright light, I know if I need a pupil-dependent multifocal lens such as the AcrySof IQ Restor (Alcon) or a non-pupil dependent lens like the Tecnis (AMO) — the Tecnis being more advantageous in low light situations.

Spherical aberration. The OPD-Scan III provides me with a picture of the total visual system, including the axial map, average pupil power and effective central corneal power. Furthermore, it's the only system that includes the spherical aberration of the cornea, which helps when I'm performing cataract surgery on patients who have previously undergone LASIK surgery. I've done about 30,000 LASIK procedures, and those patients often return for cataract removal.

Post-myopic LASIK patients usually have positive spherical aberration, and post-hyperopic LASIK patients usually have negative spherical aberration. By knowing the true amount of corneal spherical aberration (SA), I can choose the correct monofocal IOL (for example, the AMO Tecnis monofocal reduces SA by 0.27 µm and the Bausch + Lomb Akreos has an SA of 0) to reduce or eliminate any residual corneal aberration for these post-LASIK cases. The OPD-Scan III device also gives effective corneal power post-LASIK, useful for the various IOL formulas such as those found on the ASCRS website (iol.ascrs.org).

Toric IOL Advantages

The OPD-Scan III has a report called the Toric IOL Summary, which helps ensure that I achieve excellent

By Mitchell A. Jackson, MD

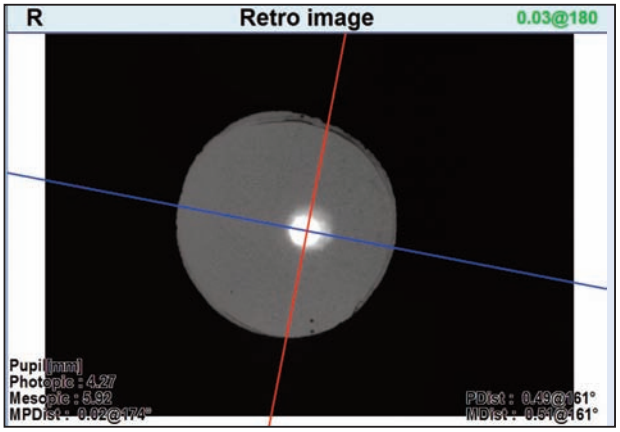

Figure 3. Retro-illumination shows alignment markings of the toric IOL at 1-day postop, showing any small change in the position of the IOL without dilation.

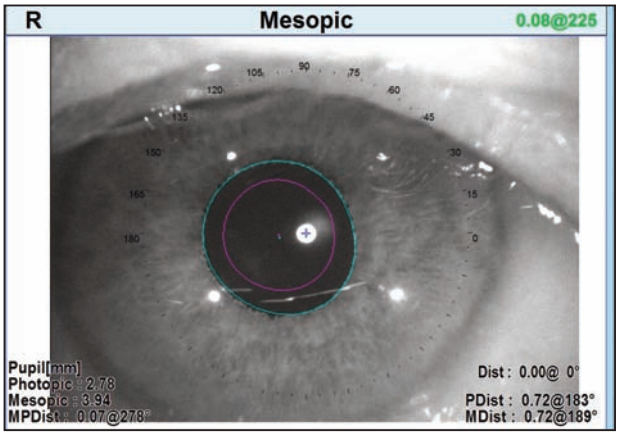

Figure 4. Eyes with high angle kappa are not good candidates for multifocal lenses.

outcomes with these lenses. Its features support accurate marking and alignment, which are extremely important with toric IOLs where just a 4° misalignment will cause a 14% loss in astigmatic effect and 10° will have a whopping 34% reduced effect.

The toric IOL summary map lets me establish a landmark for the steep axis. We mark the patient while he's in a seated position to rule out cyclotorsion and let those marks guide us during surgery. For example, the OPD-Scan III lets me mark a blood vessel on the sclera. Not having to do extra marking at the time of surgery saves time and money with accurate placement of the toric IOL.

After cataract surgery, the features of the OPD-Scan III enhance my ability to evaluate surgical outcomes. The retro-illumination image shows toric IOL alignment markings at the 1-day postop visit, which allows me to see if there's been any small change in the position of the IOL without dilating the patient (**Figures 1, 2 and 3**).

Streamlined Testing

I used an autorefractor for years, but upgrading to an integrated system has resulted in new practice efficiencies and a better patient experience.

Naturally, it takes less time to perform tests in a single sitting, rather than moving from device to device. It used to take 15 minutes going from machine to machine; now it takes less than one minute to change tests. The rapid blue light corneal topography takes only 10 seconds per eye and is better tolerated than reflection topography. These changes are efficient for us and more desirable for patients. Older patients are grateful that everything can be done in one location and younger patients appreciate the speed, since they tend to be in a hurry.

Bundling the tests streamlines data transitions as well. For cataract patients, we perform all tests with the OPD-Scan III except the A scan, and we might add the wavefront aberrometer for refractive surgery when needed. Moving data from the OPD-Scan III system to the electronic medical record is a much more efficient transition than moving it from multiple, separate devices.

Patient Education

The OPD-Scan III also helps me set patients' expectations and show them what's going to be happening inside their eye. Its corneal summary map displays any corneal issues preoperatively, so I can show patients how aberrations on the cornea can impair their vision. My staff uses the retro-illumination feature to show patients and their families the cataract and illustrate how it looked several years ago, and how it has progressed to a condition that requires removal. After surgery, patients can see their new IOLs. If there's any lens shift, tilt or haze in the posterior capsule, they can see that, too.

Finally, the visual acuity map helps me show patients the true visual results of cataract and LASIK surgery. For patients with premium IOLs, I can compare their preop vision (with and without eyeglasses) to their post-surgery vision without glasses. That's pretty dramatic. When patients don't opt for the recommended premium IOL, the visual acuity map backs up the expectations that we've set. Although we're very clear that these patients will still need glasses, they tend to compare their vision before surgery with glasses to their post-surgery vision without glasses. This map lets us compare apples to apples — without glasses before and after. From the very clinical side of cataract surgery to this very human side, the OPD-Scan III provides very clear, fast and welcome support.

Dr. Jackson is founder and director of Jacksoneye in Lake Villa, Ill.

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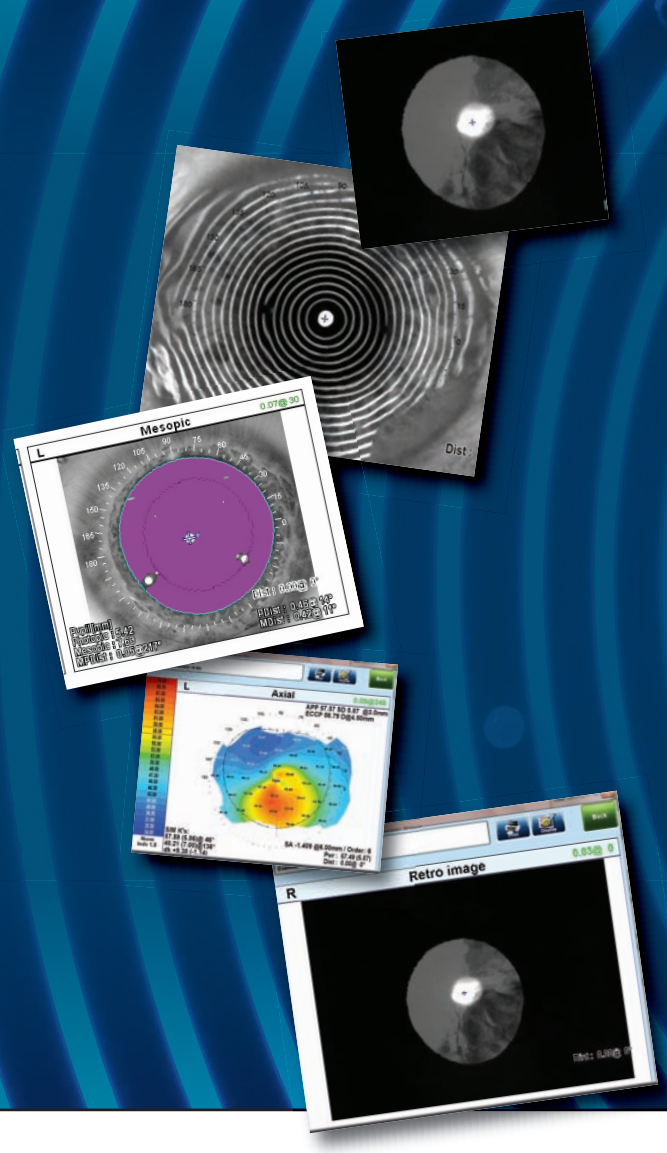

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