ESTABLISHING THE NEXT LEVEL OF EYECARE

Bringing Together Technology to Better Monitor Pathology and Intraocular Pressures

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In today's busy eyecare practice, having the right tools to quickly and reliably assess ocular pressures and pathology is the first step to making the best clinical decisions for patients. Pairing innovative imaging devices, perimeters, and handheld rebound tonometers with clinical expertise can move providers from uncertainty to greater certainty on critical issues concerning patient ophthalmic disease status.

Retinal imaging using confocal-based technology can illuminate subtle structural issues of concern, while TrueColor imaging offers exceptionally high image quality and complexity for more confidence in what providers are viewing.

Perimetry has long played a crucial part in the diagnosis and monitoring of glaucoma and retinal diseases. Now, combining visual field tests with real-time retinal tracking and confocal fundus imaging opens the door to a reliable correlation between a patient's visual function and retinal structure.

In a busy clinic, being able to measure patient intraocular pressure with 200 degrees of positional freedom whether the patient is sitting, reclined, or in a supine position overcomes a host of anatomic and logistic challenges. At the same time, rebound tonometry requiring no anesthetic drops, air, or specialized skills simplifies the measurement process, adds to patient comfort, and is available for patients to use at home.

All of these capabilities are now available through iCare—a pioneer in handheld rebound tonometry that has expanded its offerings to address other core needs in eyecare. The result has been a high level of satisfaction from a cross-section of eyecare leaders.

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GLAUCOMA TRACKING & CORNEAL EVALUATION

DR. AHMED: Please discuss how the iCare tonometer has advanced your practice.

DR. WIROSTKO: We use the IC100 in the clinic and as an alternative to dye-based application for routine exams. It requires little training, as opposed to the advanced training required for GAT, is easy to use, and is accurate. We also have found the iCare tonometer is less subjective than GAT, with less of a user "influence." Acquiring IOP in children along with people who squint or have other issues at the slit lamp is challenging with GAT. These and other patients who have trouble fitting into a slit lamp may be better candidates for the iCare tonometer.

DR. SARKISIAN: When I was in a university setting, I advocated for introducing the iCare tonometer at all of the clinics because of its clear superiority over the Tono-Pen, which we used frequently for pre- and post-retina/glaucoma laser patients, postoperative patients, and pediatric patients. A single-use sterile probe was mandatory, and many of us were frustrated by the constant need to calibrate the instrument. The iCare tonometer enables less experienced technicians who are not as skilled at GAT to provide more accurate pressure readings. Since going into private practice four years ago, I now own two iCare tonometers. The ability to capture data to 1/10th of a mmHg has been particularly helpful, and the ability to use supine is beneficial for certain patients.

"We use the iCare tonometer as a screening tool. Our technicians measure pressures with the device when they first see patients, which helps us identify individuals with high IOP that need to be seen more urgently by the doctor."

—Ike Ahmed, MD

DR. TYSON: I was actually standoffish about adding the iCare tonometer. My optometrist came to me and asked me about it, and I put it off for about a year or so. Then I brought in a cornea specialist who wanted the device for his corneal transplant and DSAEK/DMEK patients, and for irregular corneas that weren't going to yield good Kaplan-Meiers analysis. After we bought our first iCare tonometer for our cornea department, I kept hearing back from my technicians how much they liked it and how it

A New Era In Clinical Tonometry

With 200 degrees of positional freedom, the iCare IC200 tonometer measures intraocular pressure whether the patient is supine, reclined, or in a seated position. The tonometer is based on a rebound measuring principle requiring no anesthetic drops, air, or specialized skills for use.

An intuitive user interface maximizes efficiency. A green indicator light on the probe confirms tonometer positioning before measurement. The tonometer accepts only measurements taken in the correct way—perpendicularly from the center of the cornea—with individual readings displayed to one-decimal mmHg resolution, ensuring more reliable and accurate results.

Research On iCare HOME Tonometer

By Ike Ahmed, MD

Our group published a paper discussing the benefits of the iCare HOME tonometer and cases for which it may be most clinically useful.[1]

We concluded the iCare HOME tonometer "demonstrated excellent potential to transform the traditional approach to glaucoma diagnosis and management" and that it "is reasonably similar to GAT measurements, easy to use, and well accepted by patients."[1]

We determined the device was most useful for patients presenting with reasonable in-office IOP but whose disease may not be controlled due to significant visual field progression, optic nerve head and retinal nerve fiber layer changes, or other issues raising suspicion.[1]

Certain types of glaucoma patients—particularly those with pigment dispersion glaucoma, and suspects of angle-closure glaucoma and normal-tension glaucoma—were found to be especially well-suited to the home tonometer.

We also reported the iCare HOME tonometer was useful in monitoring postoperative IOP control and progress of patients after surgical interventions.[1]

1. Liu J, De Francesco T, Schlenker M, Ahmed II. Icare Home tonometer: a review of characteristics and clinical utility. Clin Ophthalmol. 2020 Nov 23;14:4031-45.

was speeding up the patient workup. I talked to my cornea specialist, and he felt that it was more than accurate so we bought several devices and started using them throughout our practice with seven locations.

The iCare tonometer has been a nice little workhorse; it speeds up our workup and adds a reliability factor because it removes some of the technical training necessary with other devices to get good readings. Overall, its ease of use and patient acceptance have been enormously valuable.

DR. AHMED: We use the iCare tonometer as a screening tool. Our technicians measure pressures with the device when they first see patients, which helps us identify individuals with high IOP that need to be seen more urgently by the doctor. With uncooperative patients or children, it enables us to get good IOP estimates. The device is easy to use, and instructions on the display as well as clear error messages help the technicians perform measurements correctly.

DR. AHMED: The iCare HOME2 tonometer, FDA-cleared in January 2022, includes a number of upgrades from its predecessor [e.g., measurements in supine position, patient mobile app, private patient cloud account, etc.) How has home tonometry improved short- and long-term patient care?

DR. WIROSTKO: With the iCare HOME2 tonometer, patient care continues to excel. The device

A Modern Approach To Diurnal IOP Monitoring

With the iCare HOME2 tonometer, patients can take IOP measurements throughout the day, at night, and when lying down. Measurement results are uploaded to a cloud database where they are accessible to the doctor and patient for accurate real-world IOP data to support treatment decisions.

iCare HOME2 tonometer

directly and immediately enables the doctor to alter treatment decisions to help slow disease progression and preserve patients' sight. We have many examples of catching IOP spikes outside of clinic hours with real-time information from the device, and have published numerous case reports on how these insights have informed medical and surgical treatment.[1] The newest home tonometer, HOME2, also empowers our patients to better understand their IOPs and fluctuations, and become more involved as a partner in their care decisions.

DR. SARKISIAN: The iCare HOME2 tonometer has captured critical data for our patients. I believe many patients are misdiagnosed as having low- or normal-tension glaucoma when in fact they simply have broad diurnal curve fluctuations. With this home tonometer, we can capture morning and late-evening IOPs. Not only does this make diagnosis more precise, but it provides more data to reassure the patient that we are in fact improving IOP fluctuation by doing treatments such as SLT or adding medications. Previously, we had to wait for a patient's glaucoma to progress before acting. In my practice, the device has also been helpful in monitoring patients after SLT to determine when repeat treatment is appropriate.

DR. AHMED: We provide (rent and sell) the iCare HOME and HOME2 tonometers to our patients and actually use it frequently in our clinic. After individual training, patients rent the device for a number of days to perform measurements and take notes about their activity. We often use the device for normal-tension or angle-closure glaucoma patients with intermittent eye pressure spikes. We find the SD analysis and the plotted graph for our patients particularly useful.

RETINAL IMAGING

DR. AHMED: Following the merger of iCare and CenterVue in 2019, iCare added retinal imaging products, including TrueColor Confocal Imaging Systems (EIDON, EIDON AF, EIDON FA, EIDON Ultra-Widefield Module, DRSplus). Please discuss the benefits of confocal imaging technology.

DR. WIROSTKO: Non-mydriatic confocal fundus imaging technology is almost always able to power through refractive errors, cataracts, or corneal issues and produce good images. EIDON's use of real light technology, and its ability to produce sharp, crisp, and real color images make it possible to easily detect abnormalities. I can have confidence that, if I'm not seeing serious issues such as choroidal nevi, etc., the findings likely aren't pathologic. Moreover, the "flicker" function, enabling side-by-side comparison of images taken at two different time points, helps me monitor subtle changes over time. What is particularly nice is the ability to share with the patient what I'm seeing, giving them a sense of involvement and empowerment in their management.

"Confocal imaging speeds up my workup because now I can get a very good view of the back of the eye at the beginning of the exam. Even if the patient is a poor dilator, I'm not held up waiting 30 or 40 minutes for the patient to dilate. "

—Farrell C. Tyson, MD, FACS

DR. SARKISIAN: I have found major benefits of the technology to be ease of use by my staff and the ability to capture high-quality images without dilation. In addition, the "flicker" function is uniquely beneficial for image comparison once a long series of images has been obtained. My EIDON fundus camera is an excellent value considering the amazing quality of images it produces and the growing need for fundus photography in a busy ophthalmic practice.

DR. TYSON: Our practice owned several CenterVue devices prior to iCare purchasing the company so we already had an EIDON and COMPASS. We really liked the fact that we were getting TrueColor im-

Harnessing The Power Of Confocal Imaging & TrueColor

Confocal imaging is considered superior to conventional fundus photography because it blocks the backscattered light of structures from the outside of the retina focal plane, increasing sharpness, optical resolution, and contrast.

Confocal imaging maintains strong image quality, even in the case of media opacities such as cataracts, and can work with pupils as small as 2.5mm without the need for dilation.

TrueColor imaging utilized in iCare devices employs white light LED for distortion-free, exceptional color fidelity. The retina appears as it does when directly observed due to the presence of the entire visible spectrum in the captured image.

iCare EIDON TrueColor technology can potentially improve the clinician's ability to diagnose and monitor retinal diseases. One study found iCare EIDON provided more balanced color images with a wider richness of color content than a conventional flash fundus camera.[1]

In addition, iCare EIDON's higher chromaticity offers the provider greater discriminative power and the opportunity for increased accuracy when diagnosing patients.

1. Sarao V, Veritti D, Borrelli E, Sadda SVR, Poletti E, Lanzetta P. A comparison between a white LED confocal imaging system and a conventional flash fundus camera using chromaticity analysis. BMC Ophthalmol. 2019 Nov 19;19(1):231.

ages. The technology means you see what you normally see with the naked eye, but the confocal laser is able to go through a much smaller pupil, about a 2mm pupil, to produce a beautiful view of the back of the eye.

I'm primarily a cataract/refractive practice, and when I'm doing workups, the way the system takes the image makes epiretinal membranes practically glow at you so you really see them. With the 90-diopter slit lamp lens, you'd be much more challenged to pick them up. But when you're getting this comprehensive view and the epiretinal membrane is just shimmering on the image, it really makes you take notice and helps you to adjust your surgical plans.

Confocal imaging speeds up my workup because now I can get a very good view of the back of the eye at the beginning of the exam. Even if the patient is a poor dilator, I'm not held up waiting 30 or 40 minutes for the patient to dilate. I can go ahead and have a direct discussion with the patient about their eyes, their vision, and their pathology.

DR. AHMED: What is the importance of UWF's capability [up to 200˚ panoramic view] to illuminate early signs of ocular pathology in your patients, and how does this surpass standard field view?

DR. WIROSTKO: UWF's faster acquisition and wider field of view is vital for difficult imaging cases. Outlying areas are able to be imaged, giving the physician greater ability to more accurately diagnose and analyze normal vs. abnormal findings. UWF has far

iCare EIDON's ultra-widefield optics from 120° to 200° field of view allows imaging of the central retina as well as the periphery.

surpassed the original capture lens. Even if you are only able to get one picture of a patient, you can still acquire the most critical areas for diagnostic comparisons. This can be pivotal for catching diabetic retinopathies, BRVO, CRVO, etc., in the far periphery.

DR. TYSON: With UWF, you're not just getting from arcade to arcade, but you can see way out into the periphery. If you want to go even further, you can use Mosaic mode and see just about the whole back of the eye. This has helped us to confirm findings in the back of the eye and view certain pathologies more vividly.

DR. AHMED: iCare COMPASS combines visual field tests, fixation loss correction by a real-time retinal tracker, and ultra-high resolution confocal TrueColor fundus imaging for efficient assessment of function and structure, with reduction of motion artifacts. How does fundus-controlled perimetry aid you in assessing disease status?

"We have cases every day that are diagnosed, tracked, and followed more efficiently via the use of the EIDON. This is where normal fundus photography falls short or is cumbersome. "

—Barbara M. Wirostko, MD, FARVO

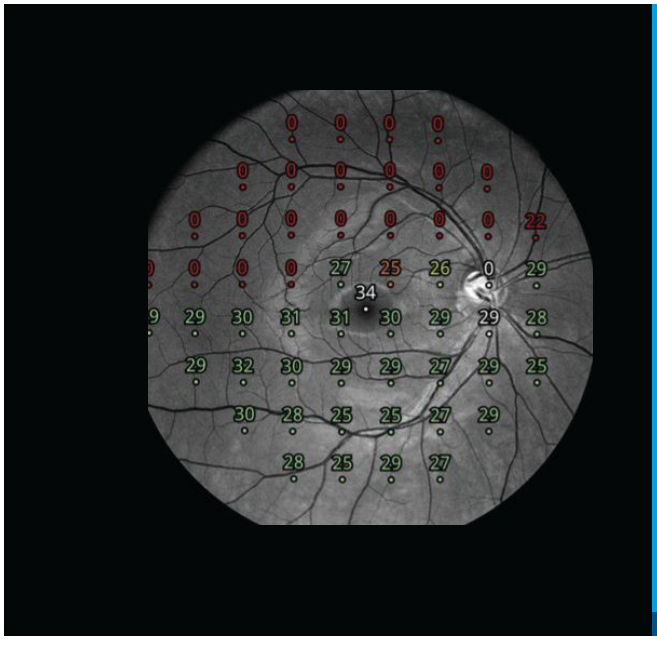
DR. TYSON: The beauty of the COMPASS is that the retina is being directly stimulated by the machine rather than indirectly off of a reflective perimetry bowl. The COMPASS knows where the nerve is, where the arcade is, which enables reproducibility. And the device can adjust for movement. With many machines, you have to do pupil tracking and see how well the patient is staying centered. We have found the COMPASS test is quicker, and more accurate and reproducible because the device knows where it is stimulating the retina and restimulates the same area from test to test.

DR. AHMED: We prefer the COMPASS visual fields over classic Humphrey fields for multiple reasons. The retinal tracker helps avoid errors caused by poor fixation and ensures accurate tracking of localized defects over multiple field tests. The high-resolution images of nerve and macula, as well as the retinal correspondence map aid us in deciding whether the field defects are glaucomatous in nature or potentially caused by retinal issues.

IMPROVING DISEASE MANAGEMENT AND PATIENT CARE

DR. AHMED: Do you have any cases to share that demonstrate how iCare technology helped you better identify or track disease, and care for patients?

DR. WIROSTKO: We have cases every day that are diagnosed, tracked, and followed more efficiently via the use of the EIDON. This is where normal fundus photography falls short or is cumbersome. The repeatable clear and sharp, colorful images that the EIDON can produce at the touch of a button are re-



Fundus-Controlled Perimetry Key Features

- Standard automated perimetry
- Active retinal tracking compensating for poor patient fixation in real-time
- Auto-focus—no trial lens needed
- Illustrative fixation analysis (fixation area and plot)
- High-resolution confocal TrueColor imaging of the retina
- The patient can blink freely and the test can be suspended at any time without data loss
- User friendly, requires minimal operator training

markable. The device makes physicians much more informed regarding treatment paths in a quick and effective manner. We use the iCare tonometer and EIDON on all of our patients with glaucomatous, retinal, and macular pathologies, and those who are pre- or post-surgery.

DR. TYSON: The COMPASS has given us the same quality as, if not better than, what we've been used to. It's not a compromise in the quality of the information we're receiving. We're getting better reproducibility and, therefore, can get fewer false positives and negatives. At the same time, we're gaining comfort from knowing the data is as accurate as what has been considered the Gold standard with Humphrey perimetry.

DR. AHMED: The iCare HOME tonometer has helped us discover high IOPs in dim lighting conditions in many of our angle-closure patients that would have otherwise been missed in the bright office. For our normal-tension glaucoma patients, minimal fluctuations are important and the iCare HOME results often lead to changes in medication (timing/frequency of drops, long- or short-lasting drugs) or indication for surgery.

"With the iCare product line, you have a range of diagnostics that touches all aspects of ophthalmology—from retina, to glaucoma, to general ophthalmology."

—Steven R. Sarkisian, Jr., MD

DR. AHMED: How can a comprehensive family of products such as the one iCare offers benefit practices across the eyecare spectrum?

DR. WIROSTKO: The iCare devices, with their diagnostic advantages, far exceed expectations and elevate patient care to ever higher levels. The ease and speed with which these devices collect accurate and vital information provides the clinician with the most up-to-date information at the touch of a button to direct specific and urgent, possibly sight-preserving changes of medical management. The iCare family delivers essential insights—from the retina to the optic nerve and cornea, offering the provider and patient the opportunity for superlative preventative care.

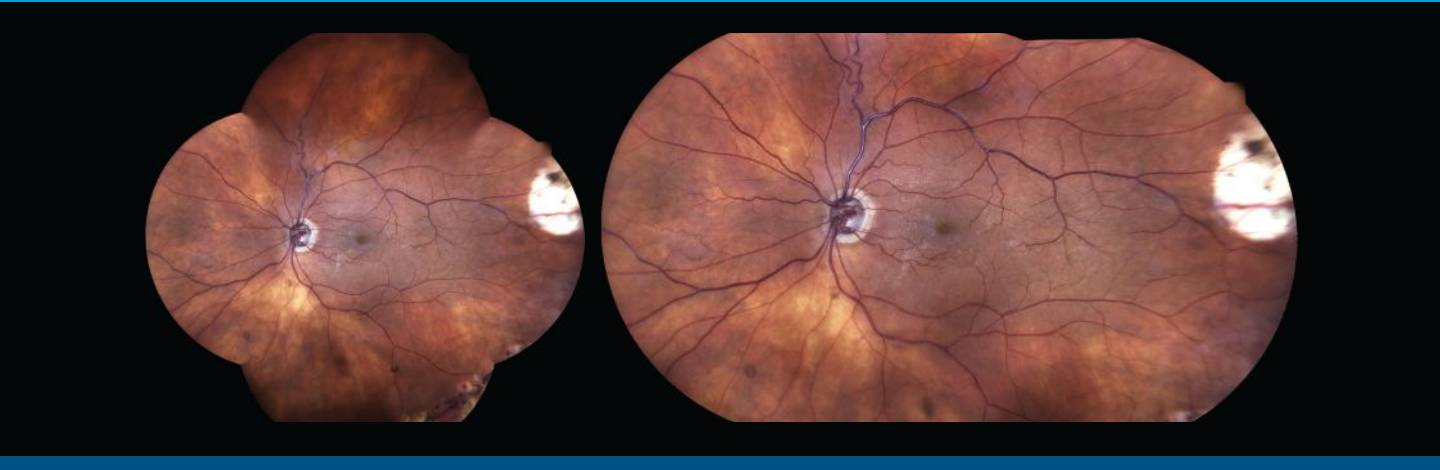
Case of Impending RVO

By Barbara M. Wirostko, MD

An 81-year-old male patient was followed for mild glaucoma damage for several years. His IOPs were well controlled, and he also had mild HTN, high cholesterol, and was a smoker.

On a routine dilated exam, he was discovered to have dilated and tortuous retinal venules in his left eye (OS) and was diagnosed as being at risk for an impending retinal vein occlusion on fluorescein angiography.

Carotids and systemic workup proved non-contributory. We made sure to control his HTN and IOP, and started him on a full aspirin a day.



EIDON widefield imaging helped illuminate a tortuous retinal venule in this patient's left eye (OS). Images: Barbara M. Wirostko, MD

DR. SARKISIAN: With the iCare product line, you have a range of diagnostics that touches all aspects of ophthalmology—from retina, to glaucoma, to general ophthalmology. As a glaucoma specialist, I would recommend all offices utilize the iCare tonometer for handheld tonometry due to its ease of use and accuracy.

DR. TYSON: iCare is giving you top-shelf technology at a very reasonable price point, enabling practices of all sizes access to the best technology in their office. And at the same time, this family of products—whether it's EIDON, COMPASS, EIDON FA, the tonometers—offers the same ease of use. Once you get the techs trained on one device, it's very simple for them to move to the next one. It's clear by all of our iCare devices that the team designing them really has the technician in mind. This isn't a technological masterpiece that nobody can operate. These devices are really straightforward and easy-to-use, but you're getting unbelievable images and testing out of them.

DR. AHMED: By providing a seamless user experience between its products, and ideally by combining all results into one single software, iCare continues to improve efficiency in today's eyecare practice. ■

1. Levin AM, McGlumphy EJ, Chaya CJ, Wirostko BM, Johnson TV. The utility of home tonometry for peri-interventional decision-making in glaucoma surgery: case series. Am J Ophthalmol Case Rep. 2022 Sep 7;28:101689.