

# Refraction Revisited

## ECPs Talk About Their Experiences With the Latest Digital Technologies

BY RICHARD MARK KIRKNER / CONTRIBUTING EDITOR

Even as eyecare professionals acquire ever more sophisticated diagnostics that enable them to evaluate the corneal surface (corneal topography) and the retinal and macular layers (optical coherence tomography), the refraction still remains the centerpiece of the comprehensive eye exam.

And technology to perform both the objective and subjective refraction has kept pace with advancements in digitization, automation and interoperability with other devices in the exam lane and the electronic medical record. That has meant more accurate measurements of refractive errors and faster exams. Whereas the traditional, manual phoropter can measure to within 0.25D



of refractive error, newer digital technologies can achieve measurements to within 0.05D.

"Digital refraction is not only here to stay but it is the future," said Paul Karpecki, OD, FAAO, a

prominent optometric practitioner, educator and author who serves as clinical and education conference advisor for *Review of Optometry*.

"Technology has simply caught up to where manufacturing more precise lenses is now possible. The idea of a 0.25D difference isn't always the lowest resolution for all patients. There are many patients that actually have a refraction that may be  $-3.00-0.75 \times 180$  but the majority will have something like  $-3.10 -0.38 \times 112$  and therefore more refinement via digital refraction systems is valuable to that patient. These new systems that include point spread function resolution and other advances

**"Digital refraction is not only here to stay but it is the future... These new systems that include point spread function resolution and other advances are changing the landscape and providing better vision to a large subset of patients."**

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Recently, two technologies have emerged that offer new options for patients who want the flexibility



Reichert's Phoropter VRx features motorized prism compensators and a split-cylinder lens to allow for faster testing for astigmatism.



of having a refraction done in their home, or conceivably, anywhere, either by the patient themselves or with the assistance of a practitioner: online refraction and smartphone-based refraction. These technologies are raising questions among some eyecare professionals about the accuracy of a prescription that skips a full subjective refraction at a phoropter or a phoropter-like device. Online refraction is particularly contentious, and has drawn the ire of optometrists who believe a self-administered vision test does not provide adequate patient care.

This article, together with *VM*'s July, 2014 cover story, "Refraction Reboot," offers an overview of current refraction technologies designed for in-office or mobile use.

### Faster Refractions

Automated refraction technology took a leap forward at the turn of the century when Marco began marketing its automated phoropter. Instead of turning dials to flip through a series of lenses to determine "which is better, one or two," the automated phoropter allows the examiner to conduct the subjective refraction from a control pad or console or,

more recently, a tablet or iPad.

Today, a host of competitors populate the automated phoropter landscape, with the newest addition being Reichert, which introduced its Phoropter VRx Digital Refraction System at Vision Expo East in March this year. As the newest entrant, Reichert may have had the most opportunity to learn from others. Reichert said it designed and engineered the Phorop-



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**- Nathan Bonilla-Warford, OD**

tor VRx with input from eyecare professionals. It has motorized prism compensators and a split-cylinder lens to allow for faster testing for astigmatism.

Marco estimates its Epic automated phoropter allows the examiner to perform a subjective refraction in three to five minutes and increase patient throughput by 50 percent to 75 percent. Vmax Vision said its Perfectus can obtain a subjective refraction to 20/20 in 30 seconds. LensCrafters started introducing its

AccuExam system, which includes a Marco automated phoropter, in its locations a couple of years ago.

### Practice Building Potential

By saving time on the subjective refraction, many eyecare professionals could add more exam slots into their daily schedules and see more patients, thus growing their practices. Nathan Bonilla-Warford, OD,

has taken a different approach to the practice building that automated refraction technology has brought to his Bright Eyes Family Vision Center in Tampa, Fla.

Dr. Bonilla-Warford has the OPD Scan III pre-testing device and TRS 5100 automated phoropter (TRS stands for total refraction system), both by Marco. "It enables you to do different things," he said. "Some doctors see more patients in a day and that's a totally realistic expectation. I do it a little differently. I spend more time talking to patients and educating them—about their expectations, glasses, sunglasses, etc. So we

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## ECPs Discuss New Refraction Technologies

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don't actually see more patients, but we have increased our capture rate because I spend more time educating them and that's more important."



**"I have not changed the length of exam time or exam price, so the time I saved in the refraction process goes right back to the patient in time for discussion and education."**

**- Kyle Sexton, OD**

Kyle Sexton, OD, proprietor of Sexton Vision Group, a three-location practice in LensCrafters in Spokane and Puyallup, Wash., has taken a similar approach thanks to the AccuExam. "I have not changed the length of exam time or exam price, so the time I saved in the refraction process goes right back to the patient in time for discussion and education. And because the price of the exam has not changed, profit is not directly affected, but I can say that the swell of enthusiasm and word of mouth have increased our eye exam count significantly, so that has definitely helped business," he said.

### A Higher Quality Exam

The "digital" aspects of these technologies enable greater accuracy of measurement, resulting in more precise prescriptions that can be used to produce digitally designed and manufactured lenses.

Dr. Sexton would argue the quality of the prescription he gets from the AccuExam is more precise than he could get from a manual phoropter. That's not only a function of electronics and technology within the device; it's also a function of how much time patients spend at the phoropter.

"The traditional refraction sits the patient behind the phoropter for a much longer time, which dissociates the eyes and allows the patient to accommodate



Clockwise, from upper left: Topcon's Exam 5000 system includes a chart projector, autorefractor and topographer or keratometer; Marco's Epic automated phoropter can be used to perform a subjective refraction in three to five minutes; Marco's OPD-Scan III combines an autorefractor and a corneal analyzer.

behind the phoropter," he said. "Additionally, having the patient judge between the repeated lens choices of a traditional refraction can cause fatigue, all of which can change the prescription. AccuExam not only significantly reduces time behind the phoropter, it also removes the need to ask patients to make repeated lens choices, allowing for a more real-world, objective Rx."

### Part of a Package

Device manufacturers are packaging their digital phoropters with other devices as fully automated examination lanes, which are also compatible with electronic health records, allowing instantaneous downloading of a patient's visual acuity data with other clinical information like intraocular pressures and fundus exam findings.

The TRS 5100 Dr. Bonilla-Warford uses partners Marco's latest generation of electronic refraction tech-

nology with the OPD Scan III. The AIT DR-13 Digital Refraction System has Bluetooth connectivity that enables an iPad interface to control the autorefractor, chart projector and automated phoropter.

Topcon calls its system the Exam-5000, while Veatch, another relatively new player in fully automated refraction, calls it the Veatch Digital Refraction System. These systems include a chart projector, autorefractor and topographer or keratometer. Topcon's KR-1W pre-test system adds in a wavefront aberrometer and a non-invasive dry-eye tester.

The Marco OPD-Scan III, a device that combines an autorefractor and a corneal analyzer, can provide important pre-test data for the subjective refraction. "The OPD Scan III gives me a huge amount of information that I wouldn't have otherwise," Dr. Bonilla-Warford said. "Before I even see the patient or as I'm starting to see the patient, that information sort of tells

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## How Digital Technologies Are Changing Refraction

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me what to expect from the subjective refraction.”

The AccuExam system in Dr. Sexton’s offices also incorporates the OPD-Scan III. “The amount of information we get from the wavefront aberrometer in the OPD-Scan III now allows us to educate the patient about the health of their eyes and their prescription needs to a much higher level than the autorefractor and traditional refraction ever could,” he said. “AccuExam allows me to take the refraction to a totally different place for the patient by changing the refraction process from a pain point into a positive learning experience for the patient.”

### Breaking the Mold

The Perfectus from Vmax Vision is a refractive device that looks nothing like any of the other digital refraction technology—that is, a manual phoropter but only

with a plastic skin for a sleeker, higher-tech look. The Perfectus looks more like a pregnant autorefractor. Perfectus uses a point spread function (PSF) target rather than the traditional Snellen letters, which enables a subjective refraction that can be measured to 0.05 D and 0.5-degree increments for axis angles.

Vmax Vision claims that it is five times more precise than a traditional lens-and-dial phoropter. In a paper presented at the American Society of Cataract and Refractive Surgeons in 2013, ophthalmologist Alison Gordon, MD, who had been using the device for two years, reported that of 10 patients (20 eyes) tested, 19 eyes were able to read an average of 2.5 and 3.4 additional letters/targets in the right and left eyes, respectively.

The Perfectus performs both the objective and subjective refraction in one seating at one device. Once the examiner obtains the objective, he or she can com-



Vmax Vision’s Perfectus performs both objective and subjective refractions in one seating at one device. Once the examiner obtains the objective, he or she can complete the subjective refraction in about 30 seconds to get to 20/20 and about a minute to get to 20/12.

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plete the subjective refraction in about 30 seconds to get to 20/20 and about a minute to get to 20/12.

Another new approach to digital refraction is the 20/20 Now system. The system offers a hybrid approach in which a patient sits at an automated phoropter in an eye doctor's office and a technician conducts the refraction remotely, using a video screen to communicate with the patient. The 20/20 Now company has already placed the system in a retail location in New York City and plans a national roll-out.



**The 20/20 Now system offers a hybrid approach in which a patient sits at an automated phoropter in an eye doctor's office and a technician conducts the refraction remotely, using a video screen to communicate with the patient.**

Then there is the Digital VisionOptimizer (DVO), which is being developed by Digital Vision Systems, an Atlanta-based company that describes it as "the industry's first vertically-integrated exam-product solution for delivering premium vision care and corrective eyeglasses." The system contains an objective autorefractometer and can perform subjective refractions with a resolution of .05 diopters, much higher than conventional phoropters.

According to company founder Keith Thompson, MD, the DVO will offer three new capabilities: proprietary ultra high-definition digitally surfaced eyeglasses fabricated by DVS' lens manufacturing partners that will have 25 times greater resolution than phoropter-based eyewear to provide consumers with superior eyesight and



**The Digital VisionOptimizer from Digital Vision Systems contains an objective autorefractometer and can perform subjective refractions with a resolution of .05 diopters.**

wearing comfort; a proprietary preview, compare and select emulator that allows customers to interactively customize the features of their eyeglasses for work and leisure; and a telehealth capability that will enable optometrists, ophthalmologists and opticians to consult with patients via the internet.

"The DVO allows patients to see the real optical effects of lens enhancements such as polarized filters, photochromic, AR, blue blocking using real world scenes," explained Dr. Thompson, an ophthalmologist. He also noted that "the DVO has a powerful white light engine that can emulate real discomforting glare like you would see on a bright sunny day on a lake; the wearer can then customize their lens to the level of polarization they need."

National Vision is currently beta-testing DVO and plans to introduce it in its stores in 2016, Dr. Thompson told *VM*. He said Digital Vision has also partnered with lens makers Hoya, VSP and BluTech.

### A Matter of Ergonomics

Automated refraction not only provides more data and possibly more precise subjective refractions; it saves wear and tear on the examiners back, arms and hands, a benefit that has not been lost on Dr.

Bonilla-Warford. "The actual refraction is not significantly different other than it's faster and more ergonomic because I don't have to reach around and operate the lenses—I can do it from a seated position, which I think is significant," he said.

The physical demands of performing a manual refraction have been well documented. For years, eyecare professionals have complained of chronic back pain from stooping over to reach the dials of the manual phoropter and forearm and hand pain from turning the dials. In fact, performing a manual refraction requires the examiner to be a contortionist of sorts.

One new system that offers an ergonomic design is the VX55 Digital Refraction System from Visionix. The unit also features efficient refraction management, an intuitive touch-screen interface, easy control of the vision tester directly from a tablet, and the ability to integrate with a variety of devices and EMR.



**The ergonomically designed VX55 Digital Refraction System from Visionix features a touch-screen interface that allows it to be controlled from a tablet.**

Automation of the refraction process has made it feasible for optometrists and ophthalmologists to delegate this clinical task to opticians and trained technicians, something Dr. Bonilla-Warford is looking into.

"I haven't actually delegated the basics of refraction yet, but I know people who do and I

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## Digitization, Automation and Ergonomics

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think it's a very reasonable thing to do, where the technician does the initial refraction and then I come in and give it my blessing, whereas I never would've even considered that before. But because the process is so controlled you can program the unit to have the refractionist perform in your style."

### Going Mobile

Digital refraction technology has gone beyond the subjective refraction to the objective refraction as well, leaping from the autorefractor to the smartphone. Smartphone-based systems can capture a range of objective refractions, but the autorefractor or, in more skilled hands, retinoscopy, are still the standard because they can capture a much broader range of refractive errors in the objective, or pre-test, refraction.



**"It can be hard to find well-trained optometrists, especially in the hinterlands. The SVOne broadens our ability to provide people with glasses who wouldn't otherwise have them."**

**- Jordan Kassalow, OD**

Nonetheless, mobile refraction methods have become handy adjuncts when an autorefractor isn't available for pre-testing. To Jordan Kassalow, OD, it's like adding another pre-test room in his busy Manhattan contact lens practice. He uses the SVOne smartphone-based system from SmartVision Labs to perform not only objective

refractions but also over-refractions on contact lenses when one of the two pre-test rooms in his contact lens practice is backed up.

In her four-year-old practice in Jamestown, N.Y., Kara Gibbs, OD, does not have an autorefractor. When she opened the practice, she personally performed retinoscopy for objective refractions. But as her practice got busier and she brought in a tech, she acquired the SVOne. Now, her tech can use it to obtain objective refractions, freeing Dr. Gibbs to do other tasks.

Its utility is not just limited to the office. "When I go to nursing homes, the tech comes with me and we use the SVOne as part of our pre-testing there," Dr. Gibbs said.

However, the SVOne can't fully supplant the autorefractor in the office, Dr. Kassalow said. When the practice first acquired the SVOne, he

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and his partners found the learning curve for technicians was steeper than with the desktop autorefractor, and it cannot assess the full-range of refractive errors. “We have patients who have -40.00D prescriptions,” he said. The SVOne ranges up to about -10.00D. “When you look at the normal distribution of refractive errors it covers the bulk of them, but not the outliers.”

Dr. Kassalow has found the SVOne highly useful for the mission trips he makes through his organization, VisionSpring, which has distributed 2.3 million pairs of glasses in the developing world. “It can be hard to find well-trained optometrists, especially in the hinterlands. This broadens our ability to provide people with glasses who wouldn’t otherwise have them,” he said.



**Kara Gibbs, OD, uses Smart Vision Labs’ SVOne for pre-testing.**

EyeNetra, a Somerville, Mass.-based startup specializing in smartphone-powered refraction technology, has introduced Blink, an on-demand, in-home vision testing service. Blink allows consumers to go online to schedule a refraction with a trained technician who comes to their location, a strategy that complies with telemedicine regulations in several states.

The technicians, called “Vioneers,” take a health history and operate Blink’s proprietary

optical measurement devices to conduct a vision test. The technician then shares the results with a Blink network optometrist in the same state as the customer—again, meeting telemedicine regulations of states that require in-state practitioners to perform telemedicine encounters.

“The optometrists in the current system are not necessarily connected to consumers in the way consumers would like to be connected today,” said Blink’s David Schafran, who is also a co-founder of EyeNetra. “So we’re extending the optometrists’ reach to do something that’s more in line with current consumer behavior. Instead of seeing one patient at any one time in their office, now they can see multiple patients remotely. It’s not one to one. It’s one to many.”

Dominick Maino, OD, MEd, FAAO, FCOVD-A, professor of pediatrics and binocular vision at Illinois College of Optometry/Illinois Eye Institute, and a private practitioner at Lyons Family Eyecare in Chicago, warns against people being lulled into believing that smartphone-based refractions can fully supplant the comprehensive eye exam.

“The concept of using your cell phone for refractions is awesome for third-world countries that lack the doctors, expertise and wherewithal to provide refractive services and materials,” Dr. Maino said. However, he cautioned, “There is no eye health assessment; there is no determination of binocular vision abilities; there is no ‘art’ in determining the refractive needs of the individual. As we know, coming up with a number that represents a prescription is only the first part to determining the actual prescription given. For instance, if a bifocal is required, a shorter person may need more power than that recommended for a taller person. A philatelist may need a different prescription than a person who plays the trumpet.”



**Consumers can use a computer and smartphone to take an eye test and receive a prescription within 24-hours to use at any online or physical optical retailer.**

## Refraction Goes Online

Opternative, a Chicago-based start-up, has developed an online refraction service, the first one of its kind. By using a computer and smartphone, consumers can take a 25-minute or less eye test and receive a prescription within 24 hours to use at any online or physical optical retailer. After signing up at Opternative.com, individuals follow a series of written and audio instructions that walk them through several multiple choice vision tests presented on their computer screen. Their answers are recorded using a smartphone.

Since the service debuted in July 2015, 19,000 people have created an account on the company’s website, company co-founder Aaron Dallek recently told *VM*. The test is now available in 32 states.

“Since launching, 98 percent of patients who have received a prescription from our doctors were satisfied with their prescription,” noted Dallek, who spoke at *VM*’s 2014 VM Global Leadership Summit. ■

# Refraction Revisited

## Mobile and Online Refractions Come Under Fire

**A**lthough mobile refraction is relatively new and accounts for only a small number of the total refractions performed in the U.S., the technology and its purveyors are coming under fire from some optometric organizations as well as independent optometrists.

As *Vision Monday* recently reported, Blink, the on-demand, mobile refraction service that launched in New York City this spring, is encountering pushback from state and national optometric associations. In a complaint filed July 7 with the New York State Education Department and Office of Professional Discipline, The New York State Optometric Association (NYSOA) claims that the business model behind Blink is “fundamentally inconsistent with New York State law and regulation and may pose a significant risk to the health of New Yorkers.”

NYSOA filed the complaint following a June 19 presentation by Blink before the New York State Board of Optometry. In its complaint, NYSOA objects to Blink’s use of unlicensed visioneers to perform refractions, and claims that the Blink employees may be violating the law by exceeding the scope of practice.

The complaint also claims that licensed optometrists working with Blink may violate New York state rules by delegating “patient evaluation and data-gathering tasks to the Visioneers” while failing to supervise them appropriately. NYSOA also objects to what it claims is illegal fee-splitting between an unlicensed referral service and a licensed practitioner.

“We are concerned, regardless of whatever disclaimers Blink might make, that patients who receive mobile refractions from unsupervised and unlicensed ‘Visioneers’ will assume that they have received a comprehensive eye health examination,” NYSOA president Michele Lagana, OD, said in a statement.

NYSOA is asking the Department and Office of Professional Discipline to review Blink’s operations and policies and stop its operations in New York State if Blink is found to be violating state law and regula-



A Blink “Visioneer,” (r) collecting and recording a patient’s health data.



One of the special vehicles used to transport Blink Visioneers to patients.



The Blink toolkit consists of three compact, handheld devices: the Netra, which measures the eyes’ optical power through an interactive test, the Netrometer, which reads the prescription of existing eyeglasses and the Netropter (pictured here), which tests new optical powers to find the patient’s optimal prescription.

tions. When NYSOA filed its complaint in July, Blink founder David Schafran told *VM*, “We are aware of the complaint. However, we are not yet prepared to comment, given the formal nature of the complaint and the request by the NYSOA for an investigation.”

The American Optometric Association (AOA) supports NYSOA’s position, stating that there is no substitute for an in-person, comprehensive eye exam. “AOA is not opposed to cutting-edge technology. But AOA is opposed to bad patient care,” AOA president Steven A. Loomis, OD, said in a statement. “When technology is abused in a manner that undermines the critical doctor-patient relationship, the AOA will speak out and act to insure patients receive the care they deserve.”

The AOA has also been critical of online refraction services. On its website, the organization said, “While online programs tout consumer convenience, albeit with ambiguous and sometimes inaccurate claims, the AOA contends there are severe pitfalls in separating refractive tests from annual comprehensive eye exams performed in-person by an eyecare professional.”

“The AOA continually monitors and advocates for the public in many areas,” said AOA immediate past president David A. Cockrell, OD. “We are concerned where violations of Federal or state law might exist. The AOA and our state associations will be monitoring and pressing for enforcement of all regulations and statutes. If state or federal laws need to be clarified or made more specific to better protect the public, we will advocate in every arena for passage.”

Dr. Loomis, called upon the American Academy of Ophthalmology (AAO) to rebuke what the AOA characterized as “dangerously misleading product claims” made by “online eye exams”—a thinly veiled reference to Opternative—and work with the AOA “to safeguard public health and healthy vision.”

The Illinois Optometric Association (IOA) and the Michigan Optometric Association have also challenged Opternative’s business model. ■

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