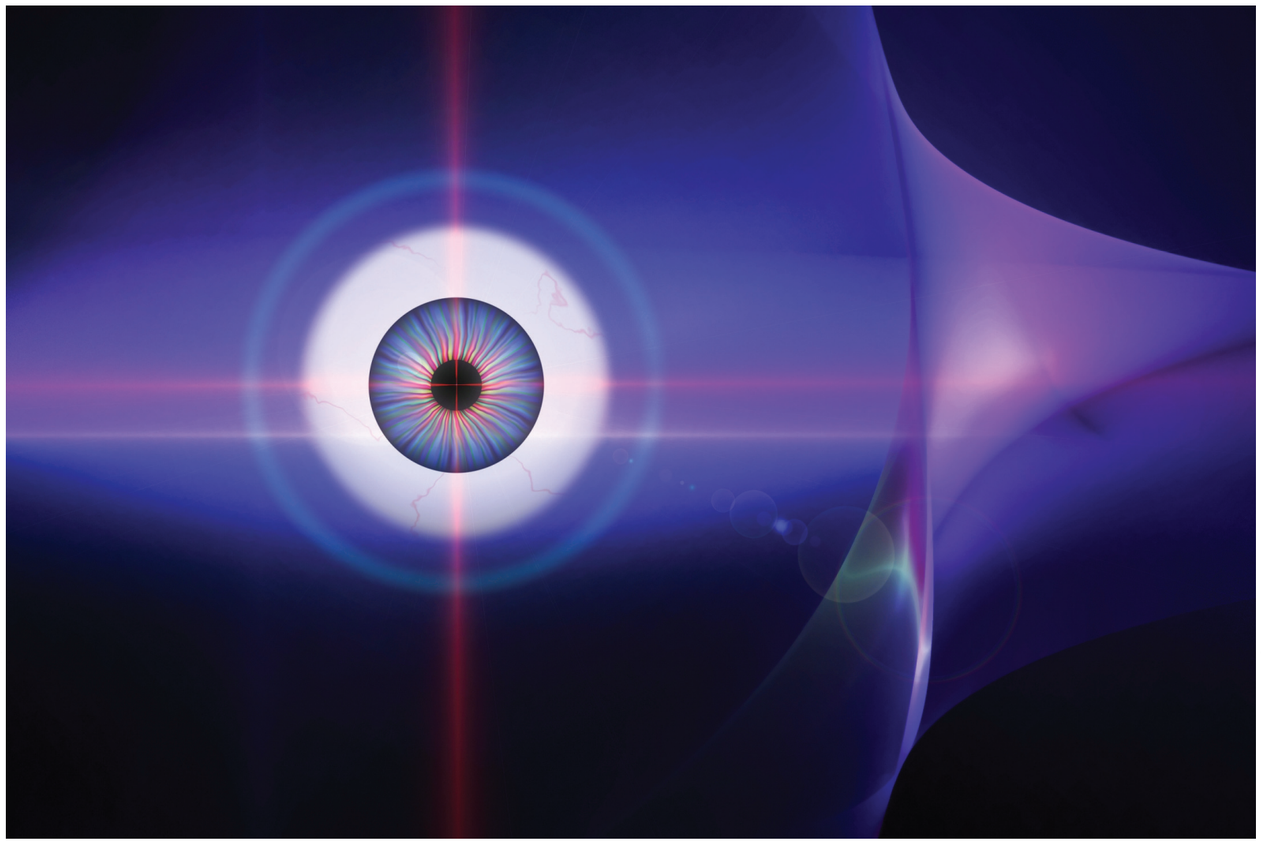
2009 DIAGNOSTIC INSTRUMENT BUYING GUIDE



INSIDE:

- Ultra-widefield imaging aids in the diagnosis and management of ocular disease.
- Ultrasound biomicroscopes afford a better view of the anterior chamber.
- Detailed listings of key diagnostic instruments.

PRODUCT LISTINGS

Raising the Bar in Ocular Imaging

Learn how posterior and anterior segment specialists are using ultra-widefield imaging to better diagnose and manage disease.

BY JUDITH RIDDLE, SENIOR EDITOR

Imagine this: You just took high-definition, digital images of the majority of a patient's retina in a single image capture. You notice pathology in the periphery that would go undetected with your conventional fundus camera. Because of your discovery with this imaging system, you accurately document your patient's pathology, make an earlier and precise treatment decision and produce a favorable visual outcome.

Welcome to the world of ultra-widefield digital imaging.

The advent of ultra-widefield imaging has virtually revolutionized the diagnosis, treatment and management of retinal disease and glaucoma. Furthermore, it has changed the way eyecare practitioners provide preoperative and postoperative care for cataract and refractive surgery patients.

Unlike conventional fundus photography that enables physicians to view up to 30º–50º of the retina at any one time, ultra-widefield imaging, specifically with the Optomap P200 Series (Optos, Marlborough, Mass.), allows ophthalmologists to view up to 200º of the retina in a single image capture — with or without mydriasis. Most often, doctors use this system as an ancillary device to help diagnose pathology in the peripheral retina that may have been missed with standard fundus cameras. The system not only allows doctors to more accurately document pathology, it also enables them to assess disease progression, monitor response to therapy and clearly detect systemic diseases, such as diabetes, hypertension and even certain types of cancers.

Because the ultra-widefield images are digital, physicians can manipulate them by magnifying, reducing, adding or subtracting color, adjusting brightness or changing contrast to zoom in on suspicious pathology.

"[Ultra-widefield imaging technology] is in the process of revolutionizing posterior segment imaging," says Douglas C. Anderson, founder of Optos, Edinburgh, Scotland. "Physicians are making substantial discoveries about the amount of proliferative disease and nonperfusion present in the eye. They're realizing the eye is much sicker than they previously thought, and they're able to treat patients sooner."

According to Sanjeev Nath, MD, a general ophthalmologist and retinal surgeon at The Eye Institute and Laser Center in New York City, ultra-widefield imaging "has markedly improved my approach to diagnosis and disease management. It enables me to see a much larger area of the retina, and I can easily obtain images that point me to pathology much more quickly."

Figure 1. Ultra-widefield angiography aids in the diagnosis and monitoring of retinal detachment (shown here), diabetic retinopathy, diabetic macular edema, inflammatory disease and cytomegalovirus.

Read on to learn how retina specialists and general ophthalmologists are using the Optomap ultra-widefield digital imaging system, which they believe is enhancing patient care and helping them build their practices.

Rave Reviews in Retina

Because retinal imaging is essential in disease detection and management of the posterior segment, many retina specialists are using the Optos P200MA device — a novel scanning laser ophthalmoscope that features ultra-widefield angiography — to aid in the diagnosis and monitoring of diabetic retinopathy, diabetic macular edema, inflammatory disease, cytomegalovirus and retinal detachment (**Figure 1**). The device provides simultaneous

CONTINUED ON PAGE 6

ULTRA-WIDEFIELD IMAGING, CONTINUED FROM PAGE 2

views of the macula and periphery, as well as a zoom mode for macular angiography. Retina specialists say the technology has greatly affected patient care and treatment in their practices.

"Ultra-widefield angiography certainly has changed and refined the way I care for patients," says John W. Kitchens, MD, a retina specialist and partner at Retina Associates of Kentucky. "I've developed a better understanding of the pathogenesis of disease, and I can detect and treat disease earlier."

Says Mathew W. MacCumber, MD, PhD, a private practitioner at Illinois Retina Associates, and associate professor and associate chair for research in the department of ophthalmology at Rush University Medical Center, "Because of this technology, we can appreciate pathology in the peripheral retina that we couldn't before. We can image through an undilated pupil or a smaller pupil, which conventional fundus photography doesn't allow us to do. The technology provides excellent images of the posterior pole, so you don't need a second camera to look at the macula. You can use it as your primary camera even in a small practice setting."

Diabetes Care

Ultra-widefield angiography is especially effective in the diagnosis and management of retinal disease associated with diabetes.

"The technology has had the most impact in diagnosing and treating diabetic retinopathy and retinal vein occlusions," Dr. MacCumber says. "These diseases affect the peripheral retina as well as the posterior pole. Ultra-widefield photography helps us to better appreciate the extent of these diseases in the periphery."

Thomas Stone, MD, a retina specialist and partner with Dr. Kitchens at Retina Associates of Kentucky, says ultra-widefield angiography, using the Optos P200MA, has changed the way he treats diabetic macular edema. Before ultra-widefield angiography, he'd initiate treatment with a focal laser. If unsuccessful, he'd administer an intravitreal injection of off-label bevacizumab

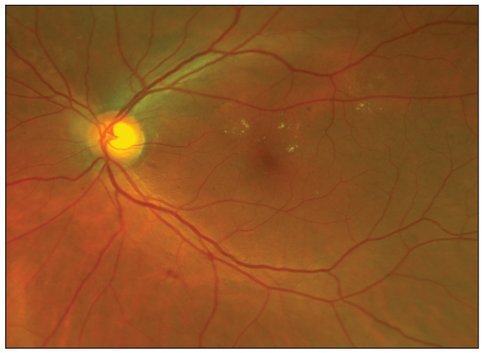


Figure 2. Ultra-widefield technology has changed the way many retina specialists treat diabetic macular edema, because they're able to target treatment more precisely to produce better visual outcomes.

REFRACTION SYSTEMS

COMPANY	MODEL	ARTIFICIAL INTELLIGENCE FINAL RX	LM/AR SUBJ/UNAIDED COMPARISON	ADJUSTABLE CONVERGENCE FOR NEAR AT VARIABLE WORKING DISTANCE	AUTOMATIC INPUT OF VA	CHART LINKAGE	AUTOMATIC ALIGNMENT W/ PROJECTION SYSTEM	ADDITIONAL FEATURES
Marco	EPIC	yes	yes	yes	yes	yes	yes	Compact refraction system; has a footprint of 22 sq. ft.; reduces refraction time; delegation tool; split prism Jackson cross; integrates wavefront data into subjective refraction; adjustable motorized table, color touch screen that can be turned to patient for visual acuity education tool, can be networked into paperless EMR systems.
Marco	TRS	yes	yes	yes	yes	yes	no (not needed)	Compact refraction system used in a tradtional lane; reduces refraction time; delegation tool; split prism Jackson cross; can be networked into paperless EMR systems.
Marco	RT-3100	no	yes	yes	yes	yes	no (not needed)	Wireless & compact refraction system used in a traditional lane; reduces refraction time; can be networked into paperless EMR systems.
Right Medical	Remote Vision	no	yes	yes	n/a	yes	no (not required)	Wireless remote control; wireless integration with Right Medical autorefractors and projector. Programmable for expedited refractions.
Topcon Medical Systems	CV-5000 Refraction System	suggested final Rx provided	yes	yes	yes	yes	yes	Incorporates color-coded cylinder refinement aids; can be integrated w/Topcon autorefractors; auto projectors, VisiChart and M&S Smart System as well as many popular EMR systems; automated patient positioning features with the EXAM-5000 desk system.

AUTOREFRACTORS

COMPANY	MODEL	ALIGNMENT SYSTEM	VISUAL ACUITY	GLARE TESTING	KERATOMETER	ADDITIONAL FEATURES
Canon Medical Systems	R-F10 Full Autorefractor	fully automated, just press start	no	no	no	2.5-mm minimum pupil size required; Dioptric measurement range of -30D to 22D; PD/VD & IOL; RS232C data output.
Canon Medical Systems	RK-F1 Full-auto Ref-keratometer	fully automated, just press start	no	no	yes	Simultaneous display of referential retro-illuminated image; 2.5-mm minimum pupil size required; corneal diameter measurement; peripheral K reading; PD/VD & IOL;RS232C data output.
Marco	ARK-530A	auto align; auto fogging; auto tracking; joystick	no	no	yes	Cataract mark detection; virtual vision comparison; corneal size measurements; Eyetracking system; photopic/scotopic pupil size measurement; measuring range -30D to +25D; interfaces w/EPIC, TRS & Evolution.
Marco	ARK-560A	auto align; joystick; infrared mire alignment; auto fogging	yes	no	yes	Auto tracking/firing/alignment measuring; visual acuity; subjective refinement; corneal size measurement; pupil size measurements; interfaces w/EPIC, TRS & Evolution.
Marco	3D Wave	auto align; joystick; auto fogging	no	no	yes	Autorefractor; topographer; wavefront analyzer; OPD; internal OPD; pupillometer; mesopic & photopic pupil displayed; asphericity values (e\Q); XP; Celeron M1.5 GHz Processor; interfaces w/EPIC, TRS & Evolution, the Marco H-D Eye Exam.
Marco	Palm AR Handheld Autorefractor	handheld; infrared mire alignment	no	no	no	Possesses features of tabletop ARs; quick mode; supine mode; interfaces w/EPIC, TRS & Evolution.
Marco	Palm ARK Handheld Autorefractor/Keratometer	handheld; infrared mire alignment	no	no	yes	Possesses features of tabletop ARKs; quick mode; supine mode; interfaces w/EPIC, TRS & Evolution.
Marco	M3	auto align; joystick; infrared mire alignment; auto fogging	no	no	yes	Autorefractor/keratometer; mesopic & photopic pupil measurements; corneal size measurements; noncontact tonometer; softer air puff; adjustable monitor; motorized chin rest; high-speed measurements; interfaces w/EPIC, TRS & Evolution.
Oculus	PARK 1	Joystick w/automatic measurement	no	no	yes	Combines a noncontact pachymeter, autorefractor and keratometer into one slim and easy-to-use instrument. 4 scan modes; 2.5 mm minimum pupil size; 5" color LCD monitor, thermal printer; 600 pachymetric points measured; USB connection and can be integrated into EMR. Dimensions: 20" x 10.2" x 21.7".
Reichert Ophthalmic Instruments	RK600 Auto Refractor/ Keratometer	joystick	n/a	n/a	yes	Full-color LCD screen, icon-based operating system & built-in printer. 2.3-mm minimum pupil diameter, RS 232C interface & video output terminal. Auto-start function initiates measurements automatically when alignment is achieved. Equipped w/an automatic power save turn off.
Right Medical	Retinomax Series 3 Handheld Autorefractor	handheld-automatic measurement	no	no	no	Handheld, fully featured. Precise measurements; Super Quick mode for optimal pediatric measurements; 2.5-mm minimum pupil size, retro-illumination to identify cataracts or irregularities in the optical system; melody function assists with small children.
Right Medical	Retinomax Series 3 K-Plus Handheld Autorefractor	handheld-automatic measurement	no	no	yes	Handheld, fully featured. Precise measurements; Super Quick mode for optimal pediatric measurements; 2.5-mm minimum pupil size, retro-illumination to identify cataracts or irregularities in the optical system; melody function assists with small children; peripheral keratometry measurements; selectable modes for optimal performance.
Right Medical	Speedy-1 Autorefractor	joystick & automatic measurement	no	no	no	The fastest measurement times - 0.01 seconds; precise measurements; 2.5-mm minimum pupil size; medical grade retro-illumination; wireless data transfer to Remote Vision auto-phoropter.
Right Medical	Speedy-K Autorefractor	joystick & automatic measurement	no	no	yes	The fastest measurement times - 0.01 seconds; precise measurements; 2.5-mm minimum pupil size; medical grade retro illumination; wireless data transfer to Remote Vision; peripheral keratometry measurements; selectable modes for optimal performance.
Shin-Nippon	ACCUREF 8001	joystick w/automatic measure	n/a	n/a	no	2.3-mm pupil; lightweight/compact design; automatic measuring function; IOL mode; continuous, quick measurement feature; data output capable; stand or sit 3-position monitor angle; large, easy read color 5.6-inch LCD monitor.
Shin-Nippon	ACCUREF 9001	joystick w/automatic measure	n/a	n/a	yes	2.3-mm pupil; corneal radius/refraction readings; compact design; IOL mode; distance & near PD measurements; automatic measuring function; continuous measurement feature; data output capable: 3-position montior angle; easy read, color 5.6-inch LCD monitor; peripheral corneal measurements.
Shin-Nippon	NVISION-K 5001	joystick w/automatic measure	n/a	n/a	yes	2.3-mm pupil; auto-refraction & auto-K measurement, corneal radius or diopter readouts; near vision testing capable; automatic measuring function; non-accommodating, wide view window technique; IOL mode data output interface large 5.6-inch LCD monitor.
Shin-Nippon	Accuref-K 9003D	hybrid - automatic 3 dimensional alignment or manual, auto measuring	n/a	n/a	yes	Fully automatic eye-tracking capability, quick and easy auto focusing and measurement function, eye-to-eye tracking is fully automatic, auto "K" measurement, peripheral "K" measurements possible, 7.5 inch Tilt TFT monitor, the new Photo Mode is standard, compact & silent operation, external output via USB port or RS232C.
Tomey USA	TR-4000	infrared; joystick; mire alignment with dual CCD	yes	no	no	Automatically calculates interpupillary distance based on patient's alignment; dual CCD cameras; 0.3-second measurement time; built-in printer.
Tomey USA	RC-5000 Autorefractor/Keratometer	fully automatic eye-tracking system	yes	no	yes	Full automatic, touch screen operation; calculates pupillary distance; high-speed built-in printer; power chin rest; 0.3-second measurement time or less; provides recommended list of contact lenses.
Tomey USA	RT-7000 Autorefractor/Keratometer	fully automatic eye-tracking system	yes	no	yes	Full automatic, touch screen operation; cataract & IOL mode; high-resolution color TFT display; 0.3-second measurement time; baseline topographer. Built-in computer & printer.
Topcon Medical Systems	RM-8900 Autorefractometer	joystick; infrared measuring	no	no	no	2-mm minimum pupil size; color LCD display; auto fogging; rotary prism technology; built-in printer; interfaces w/ Topcon auto lensmeter, CV-5000 refraction system, and today's most popular EMR systems.
Topcon Medical Systems	KR-8900 Auto Kerato-Refractometer	joystick w/auto-firing; infrared measuring	no	no	yes/std.	2-mm minimum pupil size; central K readings; color LCD display, auto fogging; rotary prism technology; auto-fire mode; built-in printer; corneal pupil diameter measurement; interfaces w/Topcon auto lensmeter, CV-5000 refraction system and today's most popular EMR systems.
Topcon Medical Systems	KR-8000PA Auto Kerato-Refractometer Topographer	joystick w/auto-firing; infrared measuring	no	no	yes/std.	2-mm minimum pupil size; corneal topography standard; peripheral keratometry; optional color-mapping software available; corneal mapping measurements out to 9.2 mm; interfaces w/Topcon auto lensmeter, CV-5000 refraction system and today's most popular EMR systems; auto fogging; rotary prism Placido ring technology.

All claims made by manufacturer

(Avastin, Genentech) or triamcinolone acetonide (Kenalog, Bristol-Myers Squibb). If this didn't resolve the edema, he'd consider vitrectomy surgery. "With this new technology, I'm able to look at the peripheral retina," Dr. Stone says. "If the patient has significant peripheral nonperfusion, I'll perform panretinal photocoagulation to the nonperfused areas. This reduces macular edema (**Figure 2**). It's less invasive than vitrectomy and may help prevent vitrectomy in the future."

Dr. Kitchens says, "If a patient has diffuse edema with poor perfusion, I'll treat him with an intravitreal injection of off-label bevacizumab. If a patient has diffuse edema with good perfusion, I'll treat him with an intravitreal corticosteroid and consider focal or grid laser photocoagulation. Before ultra-widefield angiography, my treatment decisions were almost based on trial and error. This new technology enables me to treat patients much more precisely."

What's unique about ultra-widefield angiography is that it gives physicians the ability to deliver treatment that's targeted only to the areas of the retina that need it, therefore sparing healthy tissue.

"You can take digital images of the peripheral retina in a patient with moderate-to-severe proliferative diabetic retinopathy and conclude that he'd benefit precisely from panretinal photocoagulation," Dr. Stone says. "You can miss an opportunity to make an early diagnosis and a more targeted treatment decision if you use fluorescein angiography with conventional camera systems."

Dr. Kitchens agrees. "By having the ability to determine more accurately where the problems are in the retina, you can treat the areas that need it and avoid the healthy areas that don't."

Says Dr. MacCumber, "I can direct my laser more precisely in diabetes patients who have early proliferative diabetic retinopathy. In some cases, I can avoid performing a complete panretinal photocoagulation treatment, which is something I've done routinely in the past when using conventional camera systems."

A Boon in General Ophthalmology

While ultra-widefield imaging has significance in diagnosing and treating retinal disease, it also has important applications in the general ophthalmology practice.

Thomas Henderson, MD, a cataract and refractive surgeon in private practice at Eye Clinic of Austin in Austin, Texas, uses the Optos P200C primarily to document and monitor pathology. The optometrist in his practice uses ultra-widefield imaging as a basic screening tool for 20% to 30% of healthy, well-vision patients.

"We perform basic screenings for patients who are healthy and for their convenience," Dr. Henderson says. "With one ultra-widefield image, you can see most of what you'd see with a full dilated exam. But instead of allocating 30 minutes to dilate a patient, 5 minutes to examine him and then 4 hours for the patient to recover, you spend 2 minutes taking the image and 2 minutes reviewing it with the patient. Plus, it takes 100 views with a direct ophthalmoscope to cover the area you see in one ultra-widefield image. Even then, you couldn't

AUTOREFRACTORS

COMPANY	MODEL	ALIGNMENT SYSTEM	VISUAL ACUITY	GLARE TESTING	KERATOMETER	ADDITIONAL FEATURES
Topcon Medical Systems	KR-9000PW Wavefront Analyzer	joystick w/auto-firing; infrared measuring	no	no	yes/std.	Corneal topography standard; color-mapping software; corneal-mapping measurements out to 10 mm; Hartmann-Shack wavefront analysis; Placido ring corneal measurements; 2-mm minimum pupil size; modular transfer function; point spread function.
Tracey Technologies	iTrace Combo Visual Function Analyzer	auto-align, auto-capture auto-fogging	no	no	yes	Integrated ray-tracing aberrometry, corneal topography, auto-refractometry, auto-keratometry, pupillometry in one device; multi-zonal refraction analysis at user-defined zone sizes for assessing photopic and scotopic vision.
Welch Allyn	14010 SureSight Autorefractor	direct view/data acquisition	no	no	no	Features Wavefront Sensing Technology; less than 5 seconds per eye test time; data acquisition from 14"; child-friendly; battery operated and portable; weighs 2 lbs.; IR data transfer to cordless printer.

WAVEFRONT ABERROMETERS

COMPANY	MODEL	MEASURING PRINCIPLE	METHOD	NUMBER OF DATA POINTS	POINT SPREAD FUNCTION	INTERNAL OPD/ LENTICULAR DIFFERENCE	ZERNIKE OUTPUT	ADDITIONAL FEATURES
Marco	3D Wave	dynamic spatial skiascopy	optical path difference	1,440	yes	yes	WF Refraction & RMS value on thermal tape. Zernike map displays bar graphs, WF error & RMS values given.	Topographer; Wavefront analyzer; OPD; internal OPD; pupillometer; mesopic & photopic pupil displayed; combined w/automated phoropter performs the Marco H-D Eye Exam; XP; Celeron M1.5 GHz Processor.
Ophthonix Inc.	Z-View	holographic grating	binocular viewing, monocular measurement	>10,000 over 6 mm pupil	displayed & printed as convolved image	no	2nd to 6th order	The Z-View is designed specifically for dispensing practitioners to prescribe iZon wavefront-guided lenses; wholly contained; ultramodern design; non-Hartmann-Shack; contemporary design; compact size.
Topcon Medical Systems	KR-9000PW	Hartmann-Shack	n/a	3,960 corneal	yes	no	yes	Combined autorefraction, corneal mapping and wavefront aberrometer measurements; point spread and modulation transfer functions; Landolt simulation; extensive +22D to -25D refractive measuring range; auto-fogging fixation target; axial & instantaneous power maps; mesopic and photopic measurements.
Tracey Technologies	iTrace Combo Visual Function Analyzer	Infrared laser ray tracing	Auto-capture with monocular/binocular open-field and Badal Optometer fixation	256 rapid sequential points through 2 mm-8 mm pupils	true, directly-measured PSF	yes	yes; including multizonal Zernike displayed as bar graphs, coefficients, or combined RMS and individual RMS term	5-in-1 functionality also includes corneal topography, auto-refraction w/multi-zone analysis for photopic and scotopic conditions, pupillometry and keratometry; binocular open-field fixation; accommodation volume; VFA Summary display; computer independent.

PERIMETERS

COMPANY	MODEL	STIMULUS	AREA OF FIELD	STANDARD TESTS	PRINTER	TEST STRATEGIES	ADDITIONAL FEATURES
Carl Zeiss Meditec	Humphrey Field Analyzer II-i Model 720i	Goldmann std. proj. size III only; Heijl-Krakau fixation monitor & video eye monitor	90°	threshold: 3 central, 1 periph. pattern; 4 screening central, 3 full-field periph. patterns	built-in thermal; can be hooked up to HP LaserJet	threshold: SITA, FastPac; full screen: age ref. strategy; threshold-related; 2-zone, 3-zone & quantify defects	Now with VFI, EasyConnect and HFA-Net Pro standard. Computerized silent projection system; reduces threshold testing by up to 70%; 12 test patterns w/static threshold & screening strategies to 90º; STATPAC2 software compares results w/age-matched normative data; CRT touch screen; wheelchair-accessible table w/built-in printer avail. DICOM Gateway compatible (optional).
Carl Zeiss Meditec	Humphrey Field Analyzer II-i Model 740i	Goldmann std. proj. size I, II, III, IV, V; Heijl-Krakau fixation monitor & video eye monitor; gaze tracking	90°	threshold: 4 central, 2 periph. patterns; screening: 5 central screening, 7 full-field/ periph. patterns	built-in thermal; can be hooked up to HP LaserJet	threshold: SITA, FastPac; full screen: age ref. strategy; threshold-related; 2-zone, 3-zone & quantify defects	Now with VFI, EasyConnect and HFA-Net Pro standard.19 test patterns; user-designed custom testing w/range to 90º; patented gaze-tracking system; built-in 40 GB data storage; compares multiple STATPAC results via print-out; Goldmann I-V foveal threshold testing; red/blue testing; custom testing avail.; built-in VGA monitor hookup for remote viewing. DICOM Gateway compatible (optional).
Carl Zeiss Meditec	Humphrey Field Analyzer II-i Model 745i	Goldmann std. proj. size I, II, III, IV, V; Heijl-Krakau fixation monitor & video eye monitor; gaze tracking	90°	threshold: 4 central, 2 periph. patterns: screening: 5 central, 7 full-field/periph patterns	built-in thermal; can be hooked up to HP LaserJet	threshold: SITA, FastPac; full screen: age ref strategy; threshold-related; 2-zone, 3-zone & quantity defects	Now with VFI, EasyConnect and HFA-Net Pro standard. Includes all features of 740i; STATPAC for blue/yellow perimetry. DICOM Gateway compatible (optional).
Carl Zeiss Meditec	Humphrey Field Analyzer II-i Model 750i	Goldmann std. proj. size I, II, III, IV, V; Heijl-Krakau fixation monitor & video eye monitor; head tracking; vertex monitor; gaze tracking	90°	threshold: 4 central, 2 periph. patterns; screening: 5 central, 7 full-field/periph. patterns	built-in thermal; can be hooked up to HP LaserJet	threshold: SITA, FastPac; full screen: age ref. strategy; threshold-related; 2-zone, 3-zone & quantify defects	Now with VFI, EasyConnect and HFA-Net Pro standard. Model 750i includes all of the previous features plus head tracking; automatic vertex monitoring; automatic pupil measurement; std. blue/yellow testing; kinetic testing and keyboard; all models upgradable. DICOM Gateway compatible (optional).
Carl Zeiss Meditec	Humphrey FDT Visual Field Instrument with frequency doubling	frequency doubled sinusoidal gratings (0.25 cpd; 25 Hz)	30°	screening: C-20 full threshold: C-20, N-30	n/a	n/a	45-second screening; 4-minute threshold; 19 lbs.; easy to use; age-related normative database.
Carl Zeiss Meditec	Humphrey Matrix Visual Field Instrument with frequency doubling	frequency doubled sinusoidal gratings	30°	screening: N-30,24-2 threshold: N-30-F, 24-2 FDT, 30-2 FDT Macula: 10-2, Macula Threshold (4°)	external 8.5 x 11 color printer	screening: MOBS threshold: Zest, MOBS	Fast screen <45 seconds; 20GB HD; CD RW drive; floppy drive; external keyboard; small footprint; statistical analysis w/age-related normative database; serial field, video eye monitoring; no eye patch needed; no trial lens needed out to ± 3.00D; ambient light testing.
Carl Zeiss Meditec	SITA SWAP	blue light; Goldmann std. proj. size V stimulus	n/a	threshold; single field analysis report	n/a	24-2	Available as a licensed option on all HFA II & II-i models; 745-750; blue-yellow threshold testing in 3 to 6 minutes per eye. Makes blue-yellow testing a clinically practical tool for early detection of glaucoma. Improved reproducibility; larger dynamic range & higher sensitivity than other SWAP tests.
Haag-Streit USA	Octopus 900 BASIC	100% total fixation control; no fixation losses on printouts; video eye monitor and chin rest sensor; Goldmann standard projection I, II, III, IV, V	90º in Goldmann spherical bowl	diagnostic thresholds for glaucoma & macula; linear 32 & macula threshold; low vision; neurological; diabetes blepharoptosis; multiple screening tests, including glaucoma & 130 point screenings	Perimeter controlled by PC/monitor & ink jet printer (all provided); EyeSuite Lite Software provided for long-term storage & data analysis; easily networked; viewing stations - no charge. EZ to read 7 in 1 printout.	TOP (tendency oriented perimetry) for thresholds in just over 2.5 minutes per eye; dynamic; normal - all age related; 1 and 2 level screening tests with supra-threshold	Automatic pupil measurement; automated lens holder; stimuli presentations are adaptive to patient responses; easily upgraded to 900 PRO series; wheelchair-accessible table provided; easily integrated with electronic medical records.
Haag-Streit USA	Octopus 900 PRO	Same as BASIC + unique auto eye tracking; one system offering standard static white/white + blue/yellow + Flicker + TRUE Goldmann Kinetic + low vision + red/white.	90° in Goldmann spherical bowl.	Same as BASIC + unique custom testing allows you to build what you want where you want it.	Same as BASIC + Full 3-level EyeSuite software provided for long-term storage and data analysis.	Same as BASIC	Same as BASIC

All claims made by manufacturer

Figure 3. Ophthalmologists use ultra-widefield imaging to find and document abnormalities, such as wet AMD (shown here), that might identify certain patients as being poor candidates for cataract and refractive surgery.

cover the same area with the direct ophthalmoscope — even in a dilated eye."

Moreover, ultra-widefield imaging plays an important role in anterior segment patient care. The technology doesn't allow doctors to examine the anatomy of the anterior segment, such as the crystalline lens or cornea, but it enables them to use it in presurgical and postsurgical applications in cataract and refractive surgery patients.

"Ultra-widefield imaging is a competent way of detecting presurgical risk factors and postsurgical complications because you can view nearly the whole retina," Mr. Anderson says. "For example, if a patient had peripheral retinal breaks, you'd want to know this before cataract surgery. If the patient doesn't have retinal breaks, you'd want to know if he developed them after surgery. The Optos technology enables you to image the majority of the retina and even see through cataracts."

Peyton Neatrour, MD, a cataract and refractive surgeon at Beach Eye Care/Neatrour Eye Institute in Virginia Beach, Va., says he uses the Optos P200C to find and document abnormalities that would identify certain patients as being poor candidates for cataract and refractive surgery. "Ultra-widefield imaging enables me to image and document pathology in the retina that may limit a patient's return of vision following cataract surgery. It also gives me a more targeted prognosis of a patient's visual outcomes post cataract surgery," he says. In potential cataract surgery patients, he looks for retinal pathology such as macular holes, AMD, epiretinal membrane and macular puckering. "The ability of the technology to detect subtle choroidal nevi with the green filtered view is impressive as well," he adds.

Dr. Neatrour also uses the technology for presurgical evaluations in LASIK, CK, ICL and PRK candidates. "Patients who have myopia greater than –5 are at a higher risk for peripheral retinal pathology. Using ultra-

PERIMETERS

COMPANY	MODEL	STIMULUS	AREA OF FIELD	STANDARD TESTS	PRINTER	TEST STRATEGIES	ADDITIONAL FEATURES
Haag-Streit USA	Octopus 300 BASIC	100% total fixation control - no fixation losses on printouts; video eye monitor and forehead rest sensor; Goldmann standard projection III, V; operates in diffused room lighting	30º direct projection; far distance correction only needed.	Diagnostic thresholds for glaucoma and macula; linear 32 threshold; low vision; multiple screening tests, including 30 second per eye; 1 minute per eye	No outdated processor built in; easy to read 7-in-1 printout; auto print and/or export to our EyeSuite Lite/Advanced/Pro (available) to your own PC for long-term storage & data analysis; easily networked; no add'l charges for viewing stations.	TOP (Tendency Oriented Perimetry) for thresholds in just over 2.5 minutes per eye; dynamic; normal - all age related; 1 and 2 level screening tests with supra-threshold	Automatic pupil measurement; stimuli presentations are adaptive to patient responses; easily upgraded to 300 PRO series; wheelchair-accessible table (either compact or universal sized) available; easily integrated with electronic medical records using available EyeSuite Software package.
Haag-Streit USA	Octopus 300 PRO	Same as BASIC + unique auto eye tracking; one system offering standardized static white/white + blue/yellow + Flicker + low vision	Same as BASIC	Same as BASIC + custom testing to build muliple examinations	Same as BASIC + all 3 levels of EyeSuite (Lite/Advanced/Pro) are provided.	Same as BASIC	Same as BASIC
Haag-Streit USA	Goldmann Kinetic	True Goldmann I thru V + 1-4/a-e. Control speed of 0 (static) or 2/3/4/5/10 degree per second or free form	Software package to 900 Basic (option) & Pro (standard).	Build ANY kinetic test needed & save to library for perfectly repeated tests every time	n/a	Manual or automated Goldmann Kinetic; use of automated, guided or free vectors	Quantification of kinetic isoptors for easy comparison; field correction based on reaction time of patients response; zoom function to plot selected areas that can be used in combination with static perimetry.
Haag-Streit USA	EyeSuite Software Analysis program	EyeSuite Lite; EyeSuite Advanced; EyeSuite Pro	Archive perimetry data with single field analysis.	EyeSuite Lite standard on 900 Basic & 300 basic; EyeSuite Lite, Advanced & Pro standard on 900 & 300 Pro	n/a	n/a	Easily networked w/no extra charges for viewing stations; easily integrated w/electronic medical records. Archive perimetry data w/single-field analysis-lite + cluster trend analysis structure function graph + pro superposition images/fields. New cluster and polar graphs.
Kowa Optimed Inc.	AP-5000C	Goldmann std. proj. size II-V, Heijl-Krakau Eye fixation monitor	80º	25 test programs including threshold: Center 1 & 2, macula, periphery & meridian; screening: standard or precision; isopter: Goldmann & automatic perimeter is combined	External PC connected	threshold: IQAC aged reference screening 2,3,4 zone & quantify defects	In ocular fundus perimetry, the visual field is examined w/an ocular fundus image displayed on screen. System offers capability to overlap ocular fundus image & perimetry result so physician can better understand the retinal function.
Sightpath Medical	Foresee PHP	Dot deviation signal flashed over macular loci	Central visual field - 14º	Central visual field test for CNV determination.	External color inkjet	n/a	Normative database; easy to interpret report w/mapping, change-over-time analysis & reliability indices.
Oculus Inc.	Centerfield II	Goldmann size II; Heijl-Krakau & central fixation; video eye monitor; static white-on-white & blue-on-yellow; auto kinetic	70°	30°; 10° macula; 30°course; 36°–70°; 70°; 0°– 36°; sgl. pts. -36°; sgl. pts.-70°; 36° sectors; 10-2; 24-2; 30-2 quick screen	optional	3 suprathreshold; new CLIP threshold; fast threshold; 1 full threshold 4/2; qdrnts; sgl. pts.; user-defined	Portable; compares exams; stats pkg.; progressive display; combo stats & kinetic display; color display; exam indep. of room light; free software upgrd.; adj. test pt. duration & intervals; 30-cm radius bowl; Goldmann std.; measures pupil size; trial lens holder.
Oculus Inc.	Twinfield	Goldmann size I–III; Heijl-Krakau & central fixation; video eye monitor; static white-on-white, blue-on-yellow & red-on-white; auto & manual kinetic	90°	all of the above plus indiv. test pts.; central & entire field	optional	3 suprathreshold; new CLIP threshold; fast threshold; 1 full threshold 4/2; qdrnts; sgl. pts.; user-defined	Compares exams; stats pkg.; progressive display; combo stats & kinetic disp.; color of room light; free software upgrade; adj. test pt. duration & intervals; 30-cm radius bowl; Goldmann std.; measures pupil size; trial lens holder.
Oculus Inc.	Easyfield	Goldmann size III; Heijl-Krakau & central fixation; video eye monitor; static white-on-white	30°	10-2; 24-2; 30-2; preprogrammed quick tests	built-in	3 suprathreshold; fast threshold; full threshold 4/2; qdrnts; sgl. pts.	Less than 12 lbs; portable; stats pkg.; CCD camera; moveable headrest & cone/bowl; color LCD display; stores 40,000 exams; screening rslts. 50–70 secs.; 30-cm radius bowl; free software upgrds.; exam indep. of room light; measures pupil size.; trial lens holder; two models; built-in console/computer; can use newer model w/own PC or laptop.
OPTOPOL Technology S.A. (distributed by Canon Medical Systems)	PTS 1000	Goldmann size I-V white, blue, red, green	100º (160 with fixation shift horizontally)	Accurate threshold, Intelligent advanced threshold, screening and quick 3-zone	Printout manager with predefined printout styles	Kinetic, screening, threshold, 3-zone, fast threshold, BSV (binocular single vision), flicker (critical fusion frequency), blue on yellow (SWAP), BDT (Binocular Drivers Test), advanced - reduced field option - neurological defects option	Eye monitoring by means of built-in video camera. Advanced auto-detection of eye position. Automatic pupil diameter measurement. Automatically controlled chin-rest enables you to set proper patient's position precisely and easily. Printout manager with predefined printout styles. Network capabilities (remote database, networked review stations). Direct database back-up. Special ventilation system is used to keep fresh air throughout examination inside stimulation bowl.
Paradigm Medical Industries Inc. Dicon Inc.	TKS 5000 autoperimeter	static w/kinetic fixation; Heijl-Krakau fixation monitor	±90°	10°, 30° & 60° field patterns; 13 programs std.	Inkjet std.; color printer support w/ Fieldview.	threshold-related suprathreshold screening; quantify missed pts.; full threshold; HT	Supported by Adv. FieldView Omega Analysis software; disk storage; FieldLink upgradable; voice recognition; voice prompts.
Paradigm Medical Industries Inc. Dicon Inc.	LD 400 autoperimeter	static w/kinetic fixation; Heijl-Krakau fixation monitor.	±60°	10°, 30° & 60° field patterns; 13 programs std.	Inkjet std.; color printer support w/ Adv. FieldView.	threshold-related suprathreshold screening; quantify missed pts.; full threshold; HT	Half the size of TKS 5000 w/full-field capability; fits on rotating table; supported by FieldView Analysis software; disk storage; voice management; voice prompts; Advanced FieldView w/Fieldview download to PC.
Paradigm Medical Industries Inc. Dicon Inc.	FieldLink Automated Perimetry System	static w/kinetic fixation; Heijl-Krakau fixation monitor.	±60°	10°, 30° & 60° field patterns; 13 programs std.	Inkjet std.; color printer support w/ FieldView.	threshold-related suprathreshold screening; quantify missed pts.; full threshold; HT	Includes FieldView Omega Analysis software; FieldLink communications software; laptop computer; deluxe table; voice recognition; voice prompts; Advanced FieldView.
Paradigm Medical Industries Inc. Dicon Inc.	LD 700	Goldmann size III; Heijl-Krakau; red LED fixation targets, static	30°	screening 30°, central field, suprathreshold, full & fast threshold	optional printer	threshold-related suprathreshold; full threshold; fast threshold	11 lbs., compact, easy to use; connects to any PC or purchase w/touch screen controller; full database for patient management, output range 540-590nm, alignment controls for patient comfort.
Woodlyn/Medmont	M700	Goldmann Size III - pale green rear projection LED (red macula stimulus optional) 15 points x 3dB steps / 45 points x 1dB steps - video fixation monitoring feature	80º	central 30º, full 50°, peripheral 30º - 50º, macula 10º, glaucoma 22º/50º, neurological 50º, quickscan 22º/30º, driving 50º/80º, binocular 30º/40º, binocular driving test 160º, spatially adaptive test 50º; customize any test or build your own	use any printer via PC	central threshold, Medmont Flicker Perimetry	Instrument is controlled via PC, which allows for easy networking in your office and integration with your EMR or PM software. Software allows you to view exams in 2D or 3D, in color or greyscale, overlay retinal images over visual field exams (optional). Utilizes previous exams from patients to reduce test time and gives detailed regression reports or patient history. Customize printouts for your need.

All claims made by manufacturer

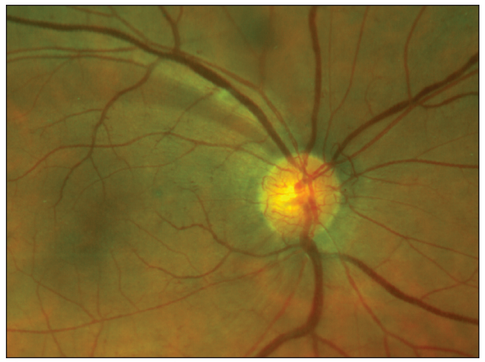


Figure 4. With ultra-widefield imaging, physicians can pinpoint glaucoma indicators, such as defects in the retinal nerve fiber layer (shown here), which are linked to an early indication of glaucoma risk. They can view optic discs on screen side by side to find asymmetries — one of the biggest risk factors in determining a glaucoma suspect.

widefield technology provides a thorough view of their eyes, which complements the dilated indirect exam," he says.

Utility in Glaucoma

Physicians also use ultra-widefield imaging to more accurately diagnose and manage glaucoma. Doctors can get a clear view of the optic nerve, measure it and examine it in both eyes side by side. In addition, clinicians can measure the ISNT rule and examine the remaining fundus to determine if any retinal pathology exists well into the periphery that might be affecting the optic nerve. These views help confirm whether or not a patient is a glaucoma suspect. "Our technology enables you to pinpoint glaucoma indicators, such as defects in the superior arcade and breaks in the retinal nerve fiber layer, which are linked to an early indication of glaucoma risk," Mr. Anderson says. "Looking at the optic discs on screen side by side is the fastest way to find asymmetry, which is one of the biggest risk factors in determining a glaucoma suspect. You can zoom in on the discs so they take up 90% of the screen."

According to Dr. Neatrour, ultra-widefield imaging enables him to see the optic nerve more clearly and document damage that occurs over time due to glaucoma progression (**Figure 4**).

Pictures Worth a Million Words

Because of the clarity of the digital images that show the posterior segment in great detail, doctors have the ability to educate patients about their eyes and eye disease like never before.

"Patients are blown away by the images," Dr. Henderson says. "You can paint a picture with your words and sometimes patients will understand. You can draw a picture with your pen, and patients may understand a little better," he says. "But when you take a picture of their eyes and show them exactly what's going on, there's no doubt they understand what's right or wrong with their eyes. This helps me forge a better therapeutic bond with my patients. I can't emphasize strongly

CORNEAL TOPOGRAPHERS

COMPANY	MODEL	RESOLUTION	PROCESSING TIME	NUMBER OF RINGS	NUMBER OF DATA POINTS	WORKING DISTANCE	FOCUSING MECHANISM	ADDITIONAL FEATURES
Carl Zeiss Meditec	ATLAS Model 9000	0.01D; submicron	less than 1 second	22	thousands	70 mm	Joystick with patented Cone of Focus™ alignment system and Smart Capture™ Technology	Proven Placido disk technology and Arc-Step Algorithm for submicron elevation accuracy. Zernike corneal wavefront analysis for aspheric IOL selection, image simulation of higher order corneal aberrations, invisible ring illumination for patient comfort; auto pupillometry (scoptopic & photopic) and white to white (HVID) measurement. PathFinder II Corneal Analysis Software screens for 5 different corneal conditions with >92% accuracy. MasterFit II CL fitting module. Small footprint, integrated Win XP computer with DVD-ROM/ethernet/USB.
Carl Zeiss Meditec	Visante *omni* (linking ATLAS with Visante OCT)	0.01D; submicron	seconds	22 (ATLAS Placido), OCT pachymetry	thousands	47 mm	V-Trac™ Registration System	Only combined Placido + OCT system for anterior and posterior corneal topography including the Holladay Report; complete anterior segment imaging with full pachymetry map, anterior chamber angle and diameter measurements, corneal flap thickness measurement; Refractive Tools Software for surgical planning; Irido-Corneal Tools Software to quantify angle anatomy; Topography Link Software compatible with ZEISS ATLAS Models 993, 995, and 9000.
EyeQuip	Piccolo Topographer	< 1 micron	< 3 seconds	28	7,168 measured 75,000 analyzed	<10 mm	patented infrared vertex detector	Corneal wavefront mapping clearly displays corneal spherical aberration and low and high order aberrations that can be removed from the map individually; slit lamp or table top mount; use your laptop or desktop computer; Exclusive Wave Contact Lens Design Software included.
EyeQuip	Scout Topographer	< 1 micron	< 3 seconds; depends on computer	28	7,168 measured 75,000 analyzed	<10 mm	patented infrared vertex detector	Std. corneal wavefront mapping clearly displays low & high-order aberrations that can be removed from the map individually; opt. IR pupillometry; three interchangeable opt. IR pupillometry; three interchangeable Scout models; portable w/battery; slit lamp mounted or table-based w/a permanent headrest; use your laptop or desktop computer; exclusive Wave Contact Lens software designs custom RGP & soft lenses.
EyeSys Vison, Inc.	System 3000	high res	computer dependent	40	up to 14,400	125 mm	3 camera apex detection with auto-capture	New desktop topographer/pupillometer. Solid state USB 2.0 digital design, patented high-resolution, 3-camera technology and patented multi-resolution, adaptable ring placido. Many options include corneal wavefront high-order aberration map, Holladay diagnostics, etc.
EyeSys Vison, Inc.	Vista Portable CT	high res	computer dependent	25	9,000	70 mm	image sequence through focus auto-capture	Newly updated for 2008. Portable, fast and easy-to-use, solid state USB 2.0 digital design, no moving parts, automatic exam acquisition, map options include corneal wavefront high order aberration map, Holladay diagnostics, etc.
Haag-Streit	CTK-922	± 0.10	instant	22	22,000	80 mm	joystick	Keratometer built-in; contact lens software; 3-D image; keratoconus detection; Fourier and Zernike analysis.
Marco	3D Wave	high res	0.4 seconds	19 vertical; 23 horizontal	6,480	75 mm	XYZ axis fully automatic alignment	Diopter range is on Ct. 10 to 100D out to 11 mm; includes: axial, tangential, refractive & elevation maps; ARK; wavefront analyzer; OPD; internal OPD; pupillometer; mesopic & photopic pupil displayed; XP; Celeron M1.5 GHzProcessor.
Nidek Inc.	OPD-Scan II, Optical Path Difference Diag. System, ARK-10000	high res	0.4 seconds	19 vertical; 23 horizontal	6,480 or more	75 mm	XYZ axis fully automatic alignment	Diopter range is on Ct.10 to 100D out to 11 mm; includes: axial, tangential, refractive & elevation maps; objective autorefraction & wavefront analysis technology via dynamic skiascopy; wavefront maps include: OPD, Zernike polynomial graphs, total wavefront aberration & wavefront higher-order aberration.
Nidek Inc.	Magellan Mapper	high res; ± .03 mm	< 1 second	60	21,600	1.5 mm	XYZ joystick w/auto-offset correction	Klyce Corneal Navigator Screening Program aiding in the detection of nine corneal conditions; Corneal Aberrometry Software; NAVIS EMR included.
Oculus Inc.	Easygraph	± 0.20D	1 second	22; high-res CCD camera	22,000	40 mm	automatic focusing; manual override	Exclusive "REAL" keratometer built in; image data transferred digitally to computer; Windows-compatible software; 3-D; overview image; Fourier analysis; height & refractive maps std.; keratoconus detection software; Zernike analysis software & contact lens fitting software opt.; contact lens software includes 35,000 lens database & fluor. image-simulation; ortho-k software also available.
Oculus Inc.	Keratograph	± 0.10D	1 second	22; high-res CCD camera	22,000	80 mm	automatic focusing; manual override	Exclusive "REAL" keratometer built in; image data transferred digitally to computer; Windows-compatible software; 3-D; overview image; Fourier analysis; height & refractive maps std; keratoconus detection software & Zernike analysis software; contact lens software includes 35,000 lens database & fluor. image simulation; refractive comparison software for corneal refractive therapy; opt. pupillometry software avail.
Oculus Inc.	Pentacam	± 0.25D	max. 2 seconds	no rings; Scheimpflug camera	25,000 true elevation pts.	80 mm	automatic focusing; manual override	The Pentacam is a rotating Scheimpflug camera system; anterior & posterior corneal topography; anterior segment/chamber analysis; calculates chamber angle in degrees, camera chamber volume, diameter & height; creates moveable 3-D model; images anterior & posterior corneal surfaces, iris & the lens; quantifies & diplays crystalline lens opacifications; measures IOL vault distance from any eye surface; detects optimal focus for anterior chamber imaging, Holladay Report with Equivalent K Readings for better IOL Calculation; 1 year free software upgrades.
Oculus Inc.	Pentacam HR (High Resolution)	+/- 0.1D	1 second	no rings; Scheimpflug camera	138,000 true elevation pts.	80 mm	automatic focusing; manual override	The Pentacam HR is a rotating Scheimpflug camera system; anterior & posterior corneal topography; anterior segment/chamber analysis; calculates chamber angle in degrees, camera chamber volume, diameter & height; creates moveable 3D model; images anterior & posterior corneal surfaces, iris & the lens; quantifies & displays crystalline lens opacifications; measures IOL vault distance from any eye surface; detects optimal focus for anterior chamber imaging, Holladay Report with Equivalent K Readings for better IOL Calculation; 1 year free software upgrades.
Shin-Nippon	CT-1000	High res ± 1.25D	< 2 seconds, depends on CPU	20	6,344	6 mm	joystick w/automatic measurement	Joystick alignment w/automatic measurement; compact design; user-friendly; easily updated software; axial, tangential, elevation, refractive, multiple, 3-D maps; comparison maps; small cone/larger measuring zone; contact lens fitting software with fluoro image stimulation.
Tomey USA	TMS-4	800 x 600 pixels	3 seconds	25 & 31	8,000	70 mm	joystick	Provides spherical equivalent, regular astigmatism, asymmetry & higher-order alignment; provides refractive information w/3-mm & 6-mm diameter range; keratoconus screening; Klyce statistics; enhanced height & height change maps; contact lens software included.
Topcon Medical Systems	KR-8000PA	n/a	n/a	10	3,600	85 mm	automatic alignment w/manual override	Tri-functional autorefractor/keratometer w/corneal mapping & contact lens fluorescein simulation fitting program; interfaces w/Topcon computerized lensmeters and CV-5000 vision tester.
Topcon Medical Systems	KR-9000PW	n/a	n/a	11	3,960	85 mm	automatic alignment w/manual overdrive	Combined autorefraction; corneal mapping & wavefront aberrometer measurements.
Tracey Technologies	iTrace Combo Visual Functional Analyzer	.01 diopter/1µ	instant	25	9,000	20 mm	laser vertex	5-in-1 functionality including ray tracing wavefront aberrometry, multi-zone auto refraction, auto-keratometry, pupillometry; topography enabled by EyeSys Vision; provides corneal spherical aberration measurement for IOL selection; measures lenticular aberrations; keratoconus screening; asphericity index; computer-independent.
Woodlyn/Medmont	E300	High resolution	none/instant	32	15,000 measured points	30 mm	joystick with progressive auto capture and 4 simultaneous captures so you never have to repeat the test	Instrument is controlled via PC, which allows for easy networking in your office and integration with your EMR or PM software. Software allows you to view exams in 2D or 3D. Fully automatic image capture keeps patient testing both fast and simple. Images are captured automatically with a simple built-in alignment system. Simply position the instrument, guided by the intuitive 3D focusing target, and let the software do the rest.

All claims made by manufacturer

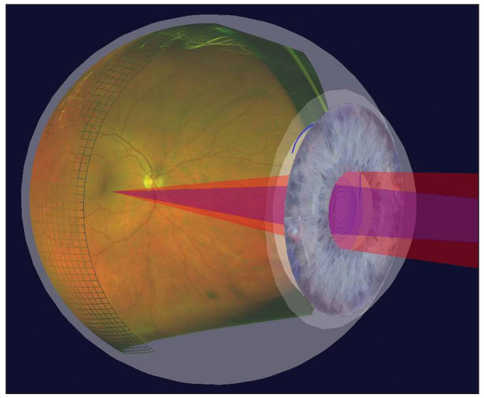


Figure 5. The 3D Wrap modeling capability feature of the Optomap P200C imaging system creates a 3-D model of patients' eyes, enabling doctors to illustrate the details of IOL placement in cataract and refractive surgery candidates. Doctors can simulate the insertion of different types of lenses, while explaining the benefits of monofocal and multifocal IOLs.

enough how much this technology reinforces the doctor-patient relationship."

Dr. Stone has had and continues to have similar experiences. "Patients are fascinated with the technology. They can see their eyes in a way they've never seen them before," he says. "When I show patients before and after treatment photos, their reactions are positive. I give them confidence about how I take care of them, and it means a lot to them."

Ultra-widefield imaging provides a big wow factor for patients, Dr. Neatrour says. He often uses the 3D Wrap Patient Orientation tool that creates a 3-D model of patients' eyes with the Optomap image in the correct position. The feature provides a virtual tour of patients' eyes to educate them about the anatomy of the eye. "The virtual tour takes patients through the cornea, pupil, the crystalline lens to the back of the eye. This helps them to understand how their condition is affecting their vision."

Another feature of the 3D Wrap is the modeling capability (**Figure 5**) that allows doctors to illustrate the details of IOL placement in cataract and refractive surgery patients. "Within this model, doctors can simulate the insertion of different types of lenses, while explaining the benefits of monofocal and multifocal IOLs. This is shown on screen in a very graphic and easy-to-understand manner. It's very exciting for patients," Mr. Anderson says.

Affordable, Profitable Investment

Despite the many invaluable features of the Optos ultra-widefield digital imaging systems, the technology is affordable for retina specialists and general ophthalmologists who have small, medium or large practices.

Unlike some of the more common financing options, such as monthly lease agreements or upfront cash purchases that manufacturers offer physicians to implement new technology, Optos provides an operating lease program called Access Technology NOW (ATN), which cov-

PACHYMETERS

NAME	MODEL	TYPE	WEIGHT	RANGE	BUILT-IN IOP CALCULATOR	PORTABILITY	POWER SOURCE	ADDITIONAL FEATURES
Accutome	AccuPach VI	desktop	3.1 lbs.	300µ to 999µ	yes	yes	universal	Voice output; gentle touch probe; easy-to-use touch screen; new Digital Signal Analysis for accuracy.
Accutome	PachPen	handheld	3 oz.	300µ to 999µ	yes	yes	lithium battery	Ergonomically designed to fit comfortably in hand; gentle touch probe; can store & average nine measurements; new Digital Signal Analysis for accuracy.
DGH Technology Inc.	DGH-55 Pachmate	handheld	3.6 oz.	200µ to 1100µ, flap option 95µ to 1100µ	yes	yes	two AAA batteries	Carrying case; extra charger; extra batteries included; bilateral mode; totally portable.
DGH Technology Inc.	DGH-550 Pachette 2	desktop	4 lbs.	200µ to 1100µ, flap option 95µ to 1100µ	yes	yes	A/C	Carrying case; extra charger; extra batteries included; bilateral mode; totally portable.
DGH Technology Inc.	DGH-555 Pachette 3	desktop	1.4 lbs.	200µ to 1100µ flap option 95µ to 1100µ	yes	yes	two AA batteries	Carrying case; extra charger; extra batteries included; bilateral mode; totally portable.
Haag-Streit USA	OLCR	slit lamp mounted	please call	please call	no	no	please call	1µ, real-time continuous readouts; PC, laptop, printer & ethernet.
Micro Medical Devices	P2000 FastPach	handheld	8 oz.	90µ to 1200µ	yes	yes	dual rechargeable batteries	Easy one-touch operation; auto data capture; advanced pattern batteries recognition; automatic IOP adjustment; corneal waveform display; hi-res color LCD and touch screen controls; wireless print; upgradeable to AP2000 (A-scan and pachymeter); ADA; 200+ patient scans on single charge.
Micro Medical Devices	P2000 Pachymeter	handheld	8 oz.	90µ to 1200µ	yes	yes	dual rechargeable batteries	Automatic IOP adjustment; corneal waveform technology batteries (A-scan of cornea); choice of 20 or 50 MHz probe; corneal mapping; FemtoScan flap measurement mode; patient database integrated desktop software; wireless sync/print, hi-res LCD touch screen controls; LRI software.
Paradigm Medical Industries, Inc. Dicon Inc.	P-2200	desktop	3.6 lbs.	200µ to 1200µ	yes	yes	A/C	Pachymeter system w/LCD monitor; 20 MHz P-probe, probe holder; calibration cylinder; foot switch; A/C adapter; built-in thermal printer.
Paradigm Medical Industries, Inc. Dicon Inc.	P-2500 P/A	desktop	3.6 lbs.	120µ to 1200µ	yes	yes	A/C	A-scan pachymeter combination; portable & sleek; 10 MHz A-scan probe & 20 MHz P-probe large LED Display w/auto gain control, 8 axial readings; 6 IOL calculations; built-in thermal printer.
Reichert Ophthalmic Instruments	ATP Auto NCT/ Pachymeter	desktop	30 lbs.	tonometer: 0 to 60 mm Hg pachymeter: 200µ to 999µ	yes	no	100V to 240V	Fully integrated tonometer/pachymeter combining the measurement of IOP & CCT in one instrument; designed in response to numerous clinical studies; presents measurements on simple-to-read color display; automatically computes adjusted IOP value w/out additional data entry.
Reichert Ophthalmic Instruments	IOPac Standard	handheld	7 oz.	300 - 1000 microns	no	yes	5V dc 300mA	One-touch measurement; automatically averages readings; built-in calibration; platform based on Palm Powered technology; straight or 45° angled probe.
Reichert Ophthalmic Instruments	IOPac Advanced	handheld	7 oz.	300 - 1000 microns	yes	yes	5V dc 300mA	Glaucoma Risk Calculator derived from the OHTS study. One-touch measurement; storage for up to 1,000 patients; refractive model for accurate measurements in multiple zones; infrared printing; color; backlit screen, straight or 45° angled probe.
Sonomed Inc.	300AP	desktop	3.25 lbs./ 1.4 kg.	100µ to 1000µ	yes	yes	A/C	A-scan & pachymeter in one unit; small footprint, portable w/touch-screen user interface; built-in probe sensitivity test & auto calibration check; straight or 45°.
Sonomed Inc.	300P	desktop	3.25 lbs./ 1.4 kg	100-1000µ	yes	yes	A/C	Small footprint, portable, w/touchscreen user interface; built-in probe sensitivity test & automatic calibration check; straight or 45° angled 20 MHz probe.
Tomey USA	SP-100	handheld	1.17 lbs.	150-1200µ	yes	yes	lithium rechargeable battery	Handheld with built-in printer; IOP calculations and network ready; simple to use and highly accurate; user programmable nomograms.
Tomey USA	SP-3000	compact/ desktop	8.8 lbs.	3 ranges: 150-350µ, 399-1000µ & 900-1500µ	no	yes	100 to 240V	Color touch screen; tone-assisted measurement & auto-averaging up to 20 readings per location; results of 10 discreet points or up to 25 map points can be displayed, stored or printed.

BINOCULAR INDIRECTS

COMPANY	MODEL	TYPE	SPOT SIZE	FILTERS	POWER SOURCE	PORTABILITY	ADDITIONAL FEATURES
Heine	SIGMA 150	S-Frame Spectacle	small & large	integrated red free; cobalt, yellow and diffuser available	mPACK lithium ion portable power source	yes with mPACK portable power source	Mounted to lightweight, fully adjustable S-Frame — weighs a mere 5.2 oz. Variable pupil scope (for optimized views in pupils 10mm-2mm); carbon fiber frame for durability. Xenon halogen bulb offers a CRI Rating of 98.5 for accurate color rendering. 100% dust-proof. Guaranteed for life.
Heine	SIGMA 150 K	headmount	small & large	integrated red free; cobalt, yellow and diffuser available	wired to stand, desktop, wall-mount and mPACK portable power source	yes with mPACK portable power source	Variable pupil scope (for optimized views in pupils 10mm-2mm); carbon fiber frame for durability. Xenon halogen bulb offers a CRI Rating of 98.5 for accurate color rendering. 100% dust-proof. Guaranteed for life.
Heine	SIGMA 150 KC	headmount	small & large	integrated red free; cobalt, yellow and diffuser available	wired to stand, desktop, wall-mount and mPACK portable power source	yes with mPACK portable power source	Variable pupil scope (for optimized views in pupils 10mm-2mm); carbon fiber frame for durability. Xenon halogen bulb offers a CRI Rating of 98.5 for accurate color rendering. 100% dust-proof. Guaranteed for life.
Heine	OMEGA 500	headmount	small, medium & large	integrated red free, cobalt, yellow and diffuser	wired to stand, wall-mount, and mPACK portable power source or unplugged wireless with mobile transformer or wall charger	yes with mPACK portable power source or unplugged wireless	Variable pupil scope (for optimized views in pupils 10mm-2mm); aluminum chassis mounting for all optical components for durability. All features fully integrated. Xenon halogen bulb offers a CRI Rating of 98.5 for accurate color rendering. 100% dust-proof guaranteed.
Heine	OMEGA 200	headmount	small, medium & large	integrated red free and cobalt; yellow available as substitution	wired to stand, desktop, wall-mount and mPACK portable power source	yes with mPACK portable power source	The choice for teaching and operating rooms. Integrated teaching mirrors on the left and right. Variable pupil scope (for optimized views in pupils 8mm-1.2mm); aluminum chassis mounting for all optical components for durability.
Keeler Instruments	All Pupil II Wired	headmount with exclusive headband dimmer control	small; medium; large	built-in UV/safety filter; red free; diffuser	3 options in 1: Smart Pack Convertible (mobile, wall or desk) or Wall Pack	yes/Smart Pack	Lightweight; less than 500 grams; easy to use; brightest; PD range 47 mm-75 mm.
Keeler Instruments	All Pupil II Wireless	headmount with exclusive headband dimmer control	small; medium; large	built-in UV/safety filter; red-free; diffuser	standard wireless; lithium ion battery; comes with two batteries	yes, wireless lithium ion battery	Lightweight; less than 500 grams; easy to use; brightest; PD range 47 mm-75 mm.
Keeler Instruments	Fison Wired	headmount	large	safety filter; red-free; cobalt blue	desk or wall-mountable transformer	no	
Keeler Instruments	Spectra Plus LED	exclusive sport frame red, light blue blue, black	large	red-free; cobalt blue	lithium ion battery	yes, lithium ion battery	LED illumination: 10,000 hours of use. 6 hours of on time. PD range 48 mm-76 mm.
Keeler Instruments	Vantage Plus Bulb Wired	headmount with exclusive headband dimmer control	Intelligent optics: small, medium, large	built-in UV/safety filter, red-free, cobalt blue diffuser	3 options in 1: Smart Pack Convertible (mobile, wall or desk) or Wall Pack	yes/Smart Pack	IOS Optics w/single step spot & convergence for maximum 3D steropsis; Hi-Mag Retina Lens to enhance visualization of the fundus; PD range 52 mm-76 mm.

All claims made by manufacturer

ers basic screenings, advanced imaging procedures and/or fundus photography and fluorescein angiography.

The company offers each ATN model with a monthly lease plan that includes service, upgrades and a pay-per-procedure payment plan. "Our most popular financing option is the operating lease model," says Thomas G. Daniells, global vice president of marketing at Optos. "The doctor pays for the Optomap service on a per-procedure pricing basis, so there's no capital outlay."

Once physicians introduce the technology, they soon realize its profit potential. However, slight differences exist between retina and general ophthalmology practices when it comes to profitability and sources of revenue.

• **Retina.** The primary source of revenue from the use of ultra-widefield imaging in retina practices comes from medically necessary reimbursable procedures, such as fundus photography and fluorescein angiography. "The financial benefit comes from the incremental use of the technology," Mr. Daniells says.

At Retina Associates of Kentucky, Drs. Kitchens and Stone perform approximately 27 fundus photography and 47 fluorescein angiography procedures per month, generating around $130,000 a year. Dr. Stone says that while high-quality patient care is the chief reason for implementing ultra-widefield technology, the system has increased revenue for certain procedures.

"Since we've had this technology, I've performed 30% more medically necessary fluorescein angiography exams and probably about 10% to 20% more Optomap fluorescein angiography-driven laser surgeries," he says.

• **General ophthalmology.** Revenue from the use of this technology in general ophthalmology practices comes from reimbursable procedures for diagnosing and monitoring retinal pathology and glaucoma, as well as from annual basic screenings that patients pay for out of pocket. This is the case in Dr. Henderson's practice. He performs approximately 86 fundus photography procedures and 80 basic screenings per month, averaging $109,000 a year.

"I do anywhere from two to 10 ultra-widefield imaging exams a day, so most busy comprehensive ophthalmologists will find this technology to be profitable and practice building," Dr. Henderson says.

Basic screenings are an important revenue stream for general ophthalmology practices, Mr. Daniells says. "Because basic screenings are done annually, physicians can compare images year after year," he adds. "If you can do 100 or more of these procedures and charge $50 to $100 a patient per month, you can bring in an additional $5,000 to $10,000 per month. Many practices can bring in an extra $100,000 per year."

Dr. Neatrour says his practice, which has three locations, expects to perform approximately 394 basic screenings per month, or 4,728 per year, and 297 fundus photography procedures per month, or 3,568 per year. As a result, projected annual revenue from the machine is $460,880.

"We believe the Optos technology provides a 4-to-1 return on investment to the practice," Dr. Neatrour says. "It's such an incredible technology for you and the patient. You'll ask yourself why you didn't introduce it sooner." **OM**

BINOCULAR INDIRECTS

COMPANY	MODEL	TYPE	SPOT SIZE	FILTERS	POWER SOURCE	PORTABILITY	ADDITIONAL FEATURES
Keeler Instruments	Vantage Plus Bulb Wireless Standard	headmount with exclusive headband dimmer control	Intelligent optics: small, medium, large	built-in UV/safety filter, red-free, cobalt blue diffuser	standard wireless; lithium ion battery; comes with two batteries	yes, w/wireless lithium ion battery	IOS Optics w/single step spot & convergence for maximum 3D steropsis; hi-mag retinal lens to enhance visualization of fundus; PD range 52 mm-76 mm.
Keeler Instruments	Vantage Plus Bulb Wireless Slimline	headmount with exclusive headband dimmer control	Intelligent optics: small, medium, large	built-in UV/safety filter, red-free, cobalt blue diffuser	slimline wireless - lithium polymer battery; comes with two batteries	yes, w/wireless lithium polymer battery	IOS Optics w/single step spot & convergence for maximum 3D steropsis; hi-mag retinal lens to enhance visualization of fundus; PD range 52 mm-76 mm.
Keeler Instruments	Vantage Plus LED Wired	headmount with exclusive headband dimmer control	Intelligent optics: small, medium, large	built-in UV/safety filter, red-free, cobalt blue diffuser	3 options in 1: Smart Pack Convertible (mobile, wall or desk) or Wall Pack	yes/Smart Pack	LED illumination:10,000 hours of use; 17 hours of on time; IOS Optics w/single step spot & convergence for maximum 3D steropsis; hi-mag retinal lens to enhance visualization of fundus; PD range 52 mm-76 mm
Keeler Instruments	Vantage Plus LED Wireless Standard	headmount with exclusive headband dimmer control	Intelligent optics: small, medium, large	built-in UV/safety filter, red-free; cobalt blue diffuser	standard wireless lithium ion battery; comes with two batteries	yes/wireless lithium ion battery	LED illumination: 10,000 hours of use; 11 hours of on time; IOS optics with single step spot & convergence of maximum 3D steropsis, hi-mag retinal lens to enhance visualization of fundus. PD range 52 mm-76 mm.
Keeler Instruments	Vantage Plus LED Wireless Slimline	headmount with exclusive headband dimmer control	Intelligent optics: small, medium, large	built-in UV/safety filter, red-free, cobalt blue diffuser	slimline wireless lithium polymer battery; comes with two batteries	yes/wireless lithium polymer battery	LED illumination: 10,000 hours of use; 6 hours of on time; IOS optics with single step spot & convergence of maximum 3D steropsis, hi-mag retinal lens to enhance visualization of fundus. PD range 52 mm-76 mm.
Keeler Instruments	Vantage Plus LED Digital	headmount with USB interface	Intelligent optics: small, medium, large	built-in UV/safety filter, red-free, cobalt blue diffuser	wireless slimline polymer battery; comes with two batteries	yes/first digital ophthalmoscope with USB interface	First digital binocular indirect system. Not old analog. Utilize Vantage Plus LED Digital Wireless in your office, operating room, and teaching facility or anywhere you want to capture digital images.
Kowa/Neitz	IO-Alpha	small pupil	small (19 mm); med. (50 mm); large (80 mm)	UV; blue; red-free	opt. cordless rechargeable battery pack; carrying case	AC power wall- or desk-mount; portable, rechargeable battery	Continuously adjustable observation angle; teaching mirror; video capability.
Kowa/Neitz	IO-H	BIO	medium	blue; red-free	opt. cordless rechargeable battery pack; carrying case	AC power wall- or desk-mount; portable, rechargeable battery	Lightweight; halogen illumination.
Kowa/Neitz	IO-TV	video BIO; small pupil	small; medium; large	UV; blue; red-free	requires AC power source for CCD camera; carrying case	AC power wall- or desk-mount; portable, rechargeable battery	Color CCD camera; continuous NTSC output.
Welch Allyn	12500 Binocular Indirect	headmount	small; medium; large	cobalt blue or yellow; red-free	portable power pack; wall- or desk-mount	yes	Video-aligned optics for crystal clear views; lightweight comfort; true small pupil capability; UV/IR filter; 100 hrs. lamp life; widest PD range (49 mm to 74 mm), leather padded headband.
Welch Allyn	12500-D Binocular Indirect	headmount	small; medium; large	diffuser; cobalt blue or yellow; red-free	portable power pack; wall- or desk-mount	yes (w/portable power source)	Diffuser filter expands illuminated area; video-aligned optics; for crystal clear views; lightweight comfort; true small pupil capability; widest PD range (49 mm to 79 mm); leather-padded headband.

RETINAL CAMERAS

COMPANY	MODEL	TYPE	FIELD OF VIEW	ANGIO-GRAPHY	NUMBER/TYPE OF PORTS	FLASH STIMULUS	VIDEO CAPACITY	ADDITIONAL FEATURES
Canon Medical Systems	CR-1 Mark II	non-mydriatic digital fundus camera	45°	no	digital	n/a	n/a	Full 45-degree retinal images, 2x magnification, 1/4 flash intensinty of the CR-1, illuminated operation panel, Swivel, 5.7" LCD monitor, single joystick operation, 15.1 MP EOS digital SLR camera back, optional imageSPECTRUM software and DICOM software.
Canon Medical Systems	CF-1	mydriatic digital fundus camera	50°	yes	digital	n/a	n/a	Small-diameter mode; color photography; red free photography; fluorescein angiography (FA); proprietary control software outputs retinal imaging information into optional imageSPECTRUM software; 10.1 MP EOS digital SLR camera back; 2X magnification and DICOM software.
Carl Zeiss Meditec	FF450 *Plus*	full-feature fundus camera for color, red free, FA, autofluorescence, and ICG. Designed for digital interface.	50°, 30°, 20°	yes	2 main interface ports; 4 digital, video and/or film cameras possible simultaneously	360 W/s Max	yes	High resolution Zeiss optics. Each angle of view has its own "telescope" lens to optimize image quality at all three magnifications; upper camera port optimized for digital interface.
Carl Zeiss Meditec	VISUCAM *PRO NM*	non-mydriatic digital fundus camera for color and red free	45°, 30°	no	internal digital sensor; USB and ethernet ports	Xenon flash lamp; 16 steps	no	All-integrated design with onboard database system. Auto-flash, auto-focus, 3.3mm small pupil mode, various preset internal fixation points and stereo capture mode. Large LCD monitor for patient management; alignment, capture and review. Network ready and DICOM conform. Telemedicine ready.
Carl Zeiss Meditec	VISUCAM *NM/FA*	non-mydriatic digital fundus camera for color, red free and FA	45°, 30°	yes	internal digital sensor; USB and ethernet ports	Xenon flash lamp; 20 steps depending on mode	no	All-integrated design with onboard database system. Auto-flash, auto-focus, 3.3mm small pupil mode, various preset internal fixation points and stereo capture mode. Large LCD monitor for patient management; alignment, capture and review. Network ready and DICOM conform. Telemedicine ready.
Carl Zeiss Meditec	VISUCAM *NM/FA FAF*	non-mydriatic digital fundus camera for color, red free, FA, autofluorescence and ICG	45°, 30°	yes	internal digital sensor; USB and ethernet ports	Xenon flash lamp; 24 steps depending on mode	no	All-integrated design with onboard database system. Auto-flash, auto-focus, 3.3mm small pupil mode, external fixation and stereo capture mode. Large LCD monitor for patient management; alignment, capture and review. Network ready and DICOM conform. Telemedicine ready.
Carl Zeiss Meditec	VISUPAC Digital Imaging and Archive Management System	digital imaging and archive system	50°, 30°, 20°	yes	4 digital sensors available; USB and ethernet ports	n/a	import, store & play video	Relational database for complete image management, documentation, progression viewing and image enhancement. Integrated report generator. Attaches to VISUPAC STAR network, integrates with other ZEISS instrument modalities. Network ready and DICOM conform.
Clarity Medical Systems	RetCam 3	digital: premature infant, children & adult anterior chamber	30º, 80º, 120º, 130º	FA option	2 USB 2.0; 1 primary; 1 Ethernet port	no flash	yes	Fully integrated imaging system that delivers the next generation of ophthalmic visualization, photo documentation and ease of use with a new user interface, redesigned cart and ergonomic hand piece. This advanced system incorporates DICOM compatibility and image annotation feature. Brilliant, full-color images can be captured for immediate assessment of the retina and anterior chamber; digital images can also be sent electronically to the ophthalmologist for immediate evaluation and longitudinal tracking over time. The RetCam 3 Digital Imaging System makes it possible to facilitate ophthalmic care in the hospital NICU, PICU and operating room.
Clarity Medical Systems	RetCam Shuttle	digital: premature infant, children & adult anterior chamber	30º, 80º, 120º 130º	no	2 USB 2.0; 1 primary; 1 Ethernet port	no flash	yes	RetCam Shuttle enables ophthalmic imaging with a convenient, mobile system that can be easily maneuvered into tight spaces and transported to affiliate hospitals. The Shuttle system enables on-site or remote documentation of the pediatric retina and pediatric or adult anterior chamber. Network capability allows transfer of images to any networked system or to a physician for remote evaluation.
Escalon Digital Solutions	E5	digital conversion of mydriatic fundus camera	any	yes	n/a	n/a	n/a	Digital imaging for most mydriatic fundus camera; 5 MP CCR sensor; calibrated measurement tools; Auto Eye-Map montage feature; DICOM-compliant; integrates with PACS and OphthaVision AXIS for side-by-side review of images from different modalities.

All claims made by manufacturer