Diagnostic Instruments: My Five Picks

Cataract & Refractive Surgery Today asked this surgeon which five diagnostic instruments he would consider purchasing and why if he were setting up a new cataract surgery practice today.

BY WARREN E. HILL, MD

If I were setting up a new cataract surgery practice today, the five diagnostic areas I would cover would be IOL power calculations, topography, optical coherence tomography, autorefraction, and intraoperative aberrometry.

IOL POWER CALCULATIONS

The Lenstar LS900 biometer (Haag-Streit AG) would be the centerpiece of my IOL power calculations. Included on the stand-alone Windows 7 computer (Microsoft Corporation) that comes with this device, I would also have the Holladay IOL Consultant (Holladay Consulting, Inc.) and PhacoOptics software programs. The Lenstar EyeSuite software communicates with these programs and is also able to autopopulate them with data, thus eliminating errors in data entry.

As a biometer, the Lenstar has many aspects that I like. Autokeratometry is one of its strongest features. The spherical equivalent of the keratometry readings (Ks) is basically the same as those of the IOLMaster (Carl Zeiss Meditec, Inc.), but that is where the similarities end.[1] Measuring two rings of 16 measurements each at 1.65 and 2.3 mm, the Lenstar takes measurements at 32 points, as opposed to the six measurement points of the IOLMaster. The greatest distance that any meridian can be located from a measurement point is approximately 11°. As a result, the Ks for the Lenstar are quite accurate for the determination of the steep and flat meridians and also the difference in power between them. This aspect makes the device especially useful for toric IOLs. The Lenstar's Ks have also been demonstrated to be equivalent to manual Ks for use with a toric IOL.[2] In addition, the Lenstar's Ks may be used with the ASCRS online postkeratorefractive surgery IOL power calculator (per my presentation at the booth of Alcon Laboratories, Inc., during the 2011 AAO Annual Meeting). The website is http://iolcalc.org/.

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The device's axial measurements are displayed in the familiar format of an immersion A-scan. The instrument segments the eye into three sections (cornea and aqueous, lens, and posterior segment) and then combines this information for an overall axial length. The precise deter-

mination of anterior chamber depth and the thickness of the lens, measured with optical biometry, are a requirement of later-generation theoretical formulas such as Holladay 2 and Olsen.

Another strong feature is that the user is allowed to scrutinize, validate, and (if necessary) adjust each measurement to achieve a clear endpoint. Each of the instrument's seven measurements can be deleted and/or repeated if necessary. Operators can also use a photographic image of the eye to confirm the horizontal corneal diameter and the pupil's diameter. At the end of the measurement process, the surgeon can be confident that each part of the biometry was correct.

TOPOGRAPHY

My choice for this test is the Zeiss Atlas 9000 topographer (Carl Zeiss Meditec, Inc.). Aside from its ability to produce an outstanding front-surface axial power map, the instrument also generates a rock-solid aberration profile and a very clever image-simulation feature that can be directly tied to the patient's individual aberration profile. This feature can be edited (Zernike coefficients added and subtracted by the user) at various pupillary sizes and, if desired, exported to a large-screen display for use as a demonstration or in teaching. On a daily basis, I use this feature to give patients an idea of what their vision will be like after surgery. It is especially useful for the postkeratorefractive surgery patient, who often has multiple, significantly elevated, higher-order aberrations. This capability helps to ensure that everyone has realistic postoperative expectations.

The Atlas 9000 is also one of the instruments extensively employed on the ASCRS online postkeratorefractive surgery IOL power calculator for prior myopic LASIK, hyperopic LASIK, and RK.[3]

POSTERIOR SEGMENT OPTICAL COHERENCE TOMOGRAPHY

Many in eye care, including myself, have found the Spectralis (Heidelberg Engineering GmbH) to be among the best devices in terms of posterior segment resolution. The ability to diagnose and follow macular disease before and after eye surgery is becoming a critical part of comprehensive ophthalmic practices. Moreover, many glaucoma specialists in my area use the instrument's retinal nerve fiber layer glaucoma assessment feature.

AUTOREFRACTION

Most autorefractors on the market are very good. If I were to purchase a new device today, the KR-1 Auto Kerato-Refractometer (Topcon Medical Systems, Inc.) would be my first choice. For a beginning physician's practice that has limited space, the moveable, automated touch screen (there is no joystick) makes it possible to set up the autorefractor against a wall—or even in a corner. Like many autorefractors, this instrument also gives a set of Ks that can be used to quickly assess patients' candidacy for toric IOLs.

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INTRAOPERATIVE ABERROMETRY

Intraoperative aberrometry is becoming an important adjunct to phacoemulsification for many upper-tier cataract surgeons. The ability to confirm the IOL's power at the end of the case has tremendous utility, especially when operating on unusual eyes such as those that previously underwent keratorefractive surgery. Intraoperative aberrometry is also uniquely suited to providing the surgeon with the best possible meridian of alignment of a toric IOL, which is a net refractive solution that also takes into account the presence of posterior corneal astigmatism.[4]

At this time, the technology of intraoperative aberrometry is rapidly evolving. I would hold off on deciding to purchase one of these devices until the Holos system (Clarity Medical Systems, Inc.) becomes commercially available. From what I have seen to date, the reasonable cost, small size, speed, dynamic range, and accuracy of this next generation of intraoperative aberration technology will be worth the wait. ■

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