

Optical Biometry for Greater Refractive Accuracy

The elimination of uncertainty is a welcome advance in preoperative measurements.

BY WARREN E. HILL, MD

The Lenstar LS900 (Haag-Streit AG) represents the newest generation of optical biometers (Figure). I have found that this instrument increases the refractive accuracy of cataract surgical outcomes, especially with premium IOLs.

AXIAL MEASUREMENTS

Using optical biometry, the Lenstar segments the eye into three sections (cornea and aqueous, lens, and posterior segment). The instrument not only provides accurate measurements of the axial length but also the central corneal thickness, anterior chamber depth (ACD), and thickness of the lens. Precise calculations of the ACD and lens thickness are a requirement of later-generation theoretical formulas such as Holladay 2 and Olsen. For future generations of IOL power calculation methodologies and also those that may employ advanced ray tracing and engineering-based statistical models, an exact measurement of the ACD and thickness of the lens will be critical.

KERATOMETRY

To me, the autokeratometry feature of the Lenstar is one of its strongest features. The spherical equivalent of its keratometry readings (Ks) is basically the same as those of the IOLMaster (Carl Zeiss Meditec, Inc.), but that is where similarities end.¹ Measuring two rings of 16 measurements each at 1.65 mm and 2.3 mm, the Lenstar carries out a total of 32 measurements

spaced 22.5° apart. The greatest distance that any meridian can be located from a measurement light-emitting diode is approximately 11°. This renders the Ks for the Lenstar highly accurate for both the determination of the steep and the flat meridians and also the difference in power between them—a quality that makes this instrument especially useful for toric IOLs. The device's Ks have been demonstrated to be equivalent to manual keratometry for use with a toric IOL.² The Lenstar's Ks may also be used with the ASCRS online postkeratorefractive surgery IOL power calculator.³

VALIDATION

One feature of this optical biometer that I particularly like is that its easy-to-understand format allows me to scrutinize, validate, and (if necessary) adjust each measurement to achieve a clear endpoint. The axial measurements are displayed in the familiar format of an immersion A-scan. I can also directly view the quality of the reflected images from the cornea for keratometry, and each measurement can be deleted and/or repeated if need be. In addition, I can use a photographic image of the eye to adjust the horizontal corneal diameter and the pupillary diameter.

A number is only as good as the interpreter's ability to understand its meaning. At the end of the examination, the operator has no doubt about the overall accuracy of the exercise, because he or she can effectively validate every measurement.



Figure. The Lenstar LS900.

INFINITI[®] System

Indication: The INFINITI[®] Vision System with OZil[®] IP is indicated for emulsification and removal of cataracts, vitreous aspiration and cutting associated with anterior vitrectomy, and bipolar coagulation.

Caution: Federal (USA) law restricts this device to sale by, or on the order of, a physician.

Warnings: Appropriate use of INFINITI[®] Vision System parameters and accessories is important for successful procedures. Use of low vacuum limits, low flow rates, low bottle heights, high power settings, extended power usage, power usage during occlusion conditions (beeping tones), failure to sufficiently aspirate viscoelastic prior to using power, excessively tight incisions, and combinations of the above actions may result in significant temperature increases at incision site and inside the eye, and lead to severe thermal eye tissue damage.

Adjusting aspiration rates or vacuum limits above the preset values, or lowering the IV pole below the preset values, may cause chamber shallowing or collapse which may result in patient injury.

When filling handpiece test chamber, if stream of fluid is weak or absent, good fluidics response will be jeopardized. Good clinical practice dictates the testing for adequate irrigation and aspiration flow prior to entering the eye.

Ensure that tubings are not occluded or pinched during any phase of operation.

The consumables used in conjunction with Alcon instrument products constitute a complete surgical system. Use of consumables and handpieces other than those manufactured by Alcon may affect system performance and create potential hazards.

AEs/Complications: Use of the NeoSoniX[®], OZil[®] torsional, U/S, or AquaLase[®] handpieces in the absence of irrigation flow and/or in the presence of reduced or lost aspiration flow can cause excessive heating and potential thermal injury to adjacent eye tissues.

Attention: Reference the Directions for Use labeling for a complete listing of indications, warnings and precautions.

FLEXIBILITY IN MEASUREMENTS

The Lenstar's computer and measurement head are separate, connected only by a simple USB cable. Third-party software containing more recent-generation formulas (eg, Holladay IOL Consultant [Holladay Consulting, Inc.] or PhacoOptics software [IOL Innovations Aps]) can reside on the Lenstar's computer and be autopopulated by the Lenstar's software. This obviates the need for manual data entry or the use of cumbersome network transfers, which makes an error in transcription a thing of the past. The device's computer is a regular stand-alone Windows 7 computer (Microsoft Corporation), which maintains the patient database indefinitely.

LENS CONSTANTS

Two studies have demonstrated that the mean difference between the Lenstar's Ks and measurements of axial length and ACD and those of the IOLMaster are clinically insignificant.^{1,4} The lens constants previously optimized for the IOLMaster therefore can be used as a starting point for the Lenstar, with surgeons' individual optimization to follow.

ERGONOMICS

With each push of a button, the Lenstar takes seven measurements: axial length, Ks, central corneal thickness, ACD, thickness of the lens, horizontal corneal diameter, and pupillary diameter. The unit's most recent software version i4000 has doubled the speed of acquisition so that this process, including positioning and alignment of the patient for a single push of the button, takes between 10 and 20 seconds. The time required of the patient is thus relatively short. Five pushes of the button are recommended for measuring each patient, which requires approximately 2 to 3 minutes on average.

SUMMARY

The only possible downside to the Lenstar is that it requires the user to be a little more sophisticated and to think about what he or she is doing. Rather than just produce numbers, the instrument provides an easy-to-understand representation of the way in which the measurements were obtained, with operator-adjusted electronic calipers. At the end of every examination, the user can confirm that the measurements are correct.

The bottom line is that there is no uncertainty about accuracy. In my experience, refractive outcomes are better, especially with one of the newer-generation IOL power calculation formulas such as Haigis, Olsen, or Holladay 2. I have found the Lenstar to be an indispensable part of my cataract and anterior segment refractive practice. ■

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2. Hill WE, Osher R, Cooke D, et al. Simulation of toric IOL results comparing manual keratometry to dual-zone automated keratometry from an integrated biometer. *J Cataract Refract Surg*. 2011;37:2181-2187.
3. Hill WE. Advanced optical biometry: better outcomes with the Haag-Streit Lenstar LS 900. Booth presentation for Alcon Laboratories, Inc., during the AAO Annual Meeting; October 23, 2011; Orlando, FL.
4. Hill WE. My experience with the Lenstar LS 900. Booth presentation for Haag-Streit AG during the AAO Annual Meeting; October 17, 2010; Chicago, IL.