New IOLMaster Advanced Technology Software

Clinical findings and revolutionary product enhancements.

BY WARREN E. HILL, MD, FACS

When the engineers at Carl Zeiss Meditec AG (Jena, Germany) first described the capabilities of the new IOLMaster Advanced Technology version 5 software, I doubted that it could possibly perform as described. I now admit that I seriously underestimated its capabilities, which practically transform the IOLMaster into a new instrument. Thanks to Carl Zeiss Meditec AG, the measurement of axial length will never be the same.

NOTABLE IMPROVEMENTS

The new IOLMaster version 5 software dramatically enhances the accuracy and reproducibility of axial length measurements by automatically analyzing them individually and as a series. Instead of reporting an average of all of the measurements taken, the IOLMaster instead uses digital-signal processing technology to generate an extremely accurate composite measurement (Figure 1) from all those that meet validation criteria. The most exciting advance of this new software is its ability to extract meaningful measurements through dense nuclear and posterior subcapsular cataracts. The end result is an extremely precise measurement of axial length in clinical settings that would have been impossible until now.

In the past, operator skill determined whether or not the IOLMaster could accurately capture axial length measurements through dense nuclear and posterior subcapsular cataracts. A signal-to-noise ratio of less than 1.8 was generally considered unusable. With a correct-appearing axial length display, signal-to-noise ratios of 2.0 to 2.5 were generally considered good, and those above 3.0 were generally considered very good to excellent. By comparison, with the Advanced Technology version 5 software, for 2+ nuclear cataracts, we are now commonly seeing signal-to-noise ratios of over 100. This improvement places axial length measurements in a completely different realm.

CASE EXAMPLE

My practice was the first in North America to receive and evaluate this newest software feature of the IOLMaster. I became convinced of its amazing capabilities almost immediately after my staff and I began using it. One of the very first patients whom we evaluated was referred to my practice by a retinal surgeon requesting that this patient's hand movements, darkly brunescent cataract be removed so that he could "see the macula." Again, I doubted that the IOLMaster could accurately measure the axial length through so dense a cataract.

As expected, most of the measurements for this eye were just above the baseline. By selecting the composite axial length feature, the software determined that the axial length was 26.16 mm. Doubting the validity of this reading, I performed a standard immersion A-scan on

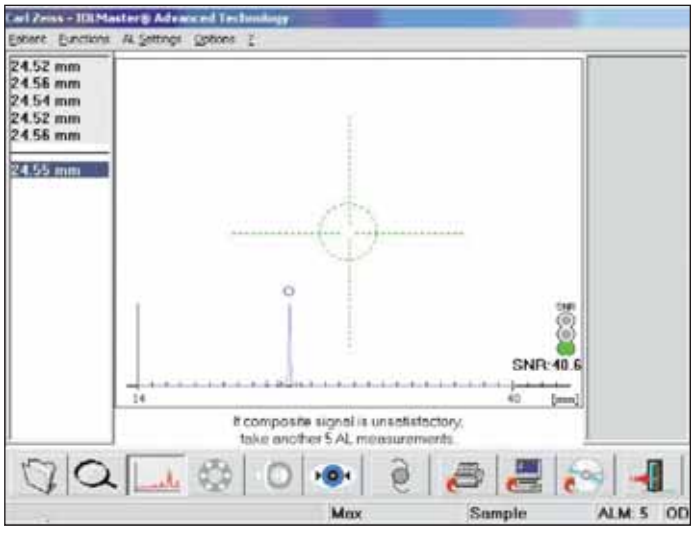

Figure 1. This image is an example of a composite axial length generated by the IOLMaster.

this eye, and it differed from the IOLMaster's composite determination by only 0.01 mm.

USING THE SOFTWARE

With the new software, the operator takes five measurements. If there is enough information to generate an adequate composite axial length, the fifth measurement stays red for about 1 second, and then a blue composite axial length measurement is automatically generated and appears on the screen. In the lower right-hand corner of the screen, there will also appear a green traffic light with the composite "enhanced" signal-to-noise ratio displayed.

Because so much of the process is now automated, the software is so easy to use that even inexperienced technicians operate it successfully.

AUTOKERATOMETRY FEATURE

For the past 20 years, I used a Javal-Schiötz keratometer to measure the central corneal power of every eye prior to cataract surgery. Since I received the IOLMaster with the version 5 software, this old and trusted friend has remained under a cover. We now use the IOLMaster's keratometry readings for every preoperative measurement. This is quite a change for someone who previously did not like this instrument's keratometry function.

One of the primary complaints about the original autokeratometry feature of the IOLMaster was that its acquisition time was relatively slow. If the ocular surface became dry between measurements, the operator would have to take more measurements in an attempt to meet the validation criteria of three measurements taken within 0.25 D in each of the principal meridians. The new version 5 software is extremely fast. The autokeratometry feature generates three measurements in about 1 second, with astounding reproducibility. Validation criteria are met within the instrument itself, and it is a simple exercise for the patient and the operator.

The autokeratometry feature includes the adjustment aid in the form of a traffic light indicator: a red light appears if the system is out of focus for keratometry, a yellow light appears if it is near the best focus position, and a green light appears when the system is ready to take measurements.

STUDY

In January 2007, our office conducted a formal study of the version 5 software in our practice. We measured 54 eyes of 36 subjects in four different ways.

First, we used the standard method of taking five consecutive measurements, calculating the mean, and gauging the validity of the result. For the second method, we took five measurements and let the machine analyze the data by generating a composite measurement. The third approach used a method that our office developed for Carl Zeiss Meditec, Inc. (Dublin, CA), years ago, in which the operator takes multiple readings around the measurement reticule, looking to find the location that returns the best axial-length display. All 20 measurements are taken, the best axial-length display is identified, and then all measurements greater than 0.02 mm on either side of this ideal measurement are discarded. For the last method, we took 20 measurements and let the machine analyze them without any input from the operator.

A slightly greater number of the patients were male, their mean age was 75 years, and 61% had vision that was between 20/40 and 20/200. All pseudophakic eyes were excluded. Eleven percent of the eyes had vision of less than 20/200, and more than 9% had finger counting or light-perception cataracts. All cataracts were graded by the Lens Opacities Classification System III as described in the *Archives of Ophthalmology* in June 1993.[1] The final results were then stratified by lens color and other criteria.

The standard method of taking five measurements and calculating the arithmetic mean produced the results we expected: not great. A little more than half of the eyes could be measured. When we gave the machine five consecutive measurements and allowed the IOLMaster to arrive at a composite value, more than 92% of patients were successfully measured. When we used our usual method of sampling multiple areas, combined with deleting outliers, 94% of patients could be successfully measured. Finally, when we took 20 measurements and simply allowed the IOLMaster software to arrive at its own conclusions, more than 96% of eyes were successfully measured. It is helpful to keep in mind that more than 9% of these eyes had count-fingers or light-perception visual acuity.

IMPLICATIONS FOR THE PRACTICE

The IOLMaster's new Advanced Technology version 5 software opens up an entirely new patient population to treatment. Its measurements are very reproducible, incredibly accurate, and require minimal operator intervention. Because of its ease of use, technicians with various skill levels can achieve the same outcomes. As far as office efficiency, patients move through this process very quickly. Everybody in my office absolutely loves our "transformed" IOLMaster. ■

Warren E. Hill, MD, FACS, is Medical Director of East Valley Ophthalmology in Mesa, Arizona. He is a consultant to Carl Zeiss Meditec, Inc. Dr. Hill may be reached at (480) 981-6111; hill@doctor-hill.com.

1. Chylack LT Jr, Wolfe JK, Singer DM, et al. The Lens Opacities Classification System III. The Longitudinal Study of Cataract Study Group. *Arch Ophthalmol.* 1993;111:831-836.