The Difference With Continuous Real-Time Refractive Data

This technology provides surgeons with a rapid sampling of wavefront data and a live video feed.

By Robert H. Osher, MD

Cataract surgery has evolved over the past few years with the help of advances including toric IOLs that correct astigmatism and femtosecond lasers that create a highly precise capsulorhexis. At the same time, intraoperative measurement of refractive error has largely remained limited. This imbalance of technologies is a potential challenge as we begin to treat more patients who have previously undergone refractive surgery. Additionally, some premium IOLs require precise positioning, which can be difficult to attain using preoperative diagnostic measurements and current IOL power calculation formulas.

The inability to properly fit bulky Hartmann-Shack technology on the end of an operating microscope largely prevented the use of aberrometry during surgery until 2010, when Talbot-Moire interferometry was introduced as an alternative aberrometric method that could be incorporated intraoperatively (WaveTec Vision).

Holos INTRAOP

The next evolutionary leap in intraoperative measurements has come to fruition with a continuous real-time wavefront aberrometer designed specifically for ophthalmic applications. Holos IntraOp (Clarity Medical Systems, Inc; Figure 1) employs rapid sampling of wavefront data in a device with a narrow profile, allowing it to be attached to a standard surgical microscope at a working distance of 150, 175, or 200 mm from the eye. The continuous real-time refraction, displayed on a separate screen, can be used for immediate management of refractive errors during cataract surgery. First-generation technology provided still images, but Holos IntraOp provides live real-time qualitative and quantitative information that is also recorded and available for later reference.

Qualitative representations of spherical error, cylinder, and emmetropia are seen as a circle, thin line, or dot, respectively, and are coaxially aligned with a live image of the eye. Quantitative data for sphere, cylinder, and axis are displayed at the bottom of the screen. Preliminary bench testing indicates that Holos IntraOp is accurate in phakic, aphakic, and pseudophakic states; can safely be active throughout the entire procedure; and does not require adjustment of the microscope or operating room lights to provide accurate results. The measurement range spans 40.00 D, according to the manufacturer.

SURGICAL IMPACT

The ability to assess current refractive information will significantly benefit cataract surgeons, especially those who routinely perform simultaneous astigmatism correction with limbal relaxing incisions (LRIs), astigmatic keratometry (AK), or toric IOLs. The astigmatic correcting power of a toric IOL may be minimized or eliminated if not correctly placed on axis, and relaxing incisions can under- or overcorrect the error. Holos IntraOp helps the surgeon to actively manage astigmatism by guiding orientation of the toric lens or titration of relaxing incisions, both in real time. Holos IntraOp can also be used to assess and manage surgically induced astigmatism. Because all intraoperative...

Figure 1. Holos IntraOp is a continuous real-time wavefront aberrometer designed specifically for ophthalmic applications.
data are captured with Holos, they are available for later assessments if desired.

During preliminary trials with Holos IntraOp, my coinvestigators and I independently concluded that the technology can potentially be used for four important tasks: (1) to confirm the spherical refractive error; (2) to identify the axis of astigmatism during surgery; (3) to manage relaxing incisions, guiding their placement and using real-time feedback for titration; and (4) to facilitate real-time alignment during rotation of the IOL.¹ These advances increase the likelihood that we will be able to achieve emmetropia for more of our cataract patients.

SEEKING EMMETROPIA

Emmetropia has been my goal for many years. I have always searched for techniques and technologies that would achieve this result for my cataract surgery patients. In the 1980s, I introduced combined AK with phacoemulsification and hyperopic clear lensectomy, in pursuit of giving my patients clear, unaided vision. The availability of continuous real-time wavefront aberrometry is likely to be invaluable. I will be able to observe how each surgical step affects the patient’s refractive measurements, which I hope will correlate with postoperative outcomes. I am excited by the potential impact of this technology.


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