Wavefront Technology for Spectacle Lenses

Can wavefront make the jump from refractive surgery to ophthalmic lenses?

Judith Lee, Contributing Editor

Now that aberrometry has become standard of care for refractive surgery, it's no surprise this technology is emerging for other forms of vision correction. The questions are whether wavefront for spectacle lenses and contact lenses makes sense, and when it will become a reality for your optical department.

Optical experts say there are some inherent problems in applying wavefront technology to either contact lenses or spectacle lenses.

"High-order aberrations, particularly coma and trefoil, are very sensitive to the actual position of correction," says Mike Morris, OD, director of technical marketing for Sola Optical. "The nice thing about refractive surgery is the correction applied is very stable. However, a contact lens moves when the patient blinks, which can degrade the quality of the correction. With spectacle lenses, the eye moves and the head moves, so the user looks through different parts of the lens, and some regions will not be corrected."

The Ophthonix Z-View aberrometer.

He notes that a spectacle lens that corrects for higher-order aberrations will have a central "sweet spot" in which the user has superior clarity of vision. As the eye moves out of this area, the correction degrades, until in the edge of the wavefront correction, vision is quite affected. "You have a kind of 'super vision' in the center, a middle region of average vision, and then an outer region with vision worse than a conventional spectacle lens," he says.

Although there are doubters in the optical industry, Ophthonix of San Diego is betting the farm that patients will adapt to these visual zones much as they do with a progressive

lens. Ophthonix introduced its aberrometer for spectacle lenses in September 2004. The company asserts that patients are highly impressed with the technology, and the "wow factor" alone makes it a good investment for any forward-thinking eye care practice.

The Ophthonix aberrometer, called the Z-View, uses proprietary technology (not the same Hartmann-Shack aberrometry used for surgery) to measure sphere, cylinder, and third- through sixth-order aberrations, then converts them into a spectacle prescription. The company promises that this prescription will offer patients "high-definition vision" they can't get with a conventional spectacle prescription.

Trouble is, Ophthonix is not yet able to offer prescription fulfillment, so optical dispensers have had to make do with conventional lens technology, which does not correct for the higher-order aberrations. In other words, practitioners can measure more points of visual error and write a prescription that reflects this, but the prescription can not yet be translated into a lens that corrects them.

In December, Ophthonix received a patent that protects its manufacturing process that "provides refractive profiles in eyeglass lenses which are able to match unique and varying optical requirements, thus providing true customized correction." The company promised to make this available in the first quarter of 2005 in the form of online prescription ordering for practices that have purchased the Z-View. The roll-out of online prescription ordering (to be offered first in California) has been delayed until the second quarter of 2005.

The Ophthonix manufacturing process sandwiches an epoxy gel between two wafers of optical plastic or glass. The company says the gel is exposed to an ultraviolet laser that cures the material in a pattern that creates the desired refractive profile. The refractive pattern can be adjusted to correct sphere, cylinder and higher-order aberrations such as coma, trefoil, spherical aberration, tetrafoil, distortion and astigmatism.

Ophthonix has sponsored a series of studies supervised by Perry S. Binder, MD, an ophthalmologist in private practice and medical director for Ophthonix. In these trials:

- Clinicians used trial frames to create a wavefront-guided prescription in a 6-mm area. The patient had the wavefront lens in front of one eye and a placebo in front of the other. Patients preferred the trial lens with the wavefront-guided prescription.
- The Z-View's accuracy was tested against Alcon, Visx and WaveLight aberrometers. Patients were tested on all the aberrometers, and the measurements were compared to a manifest refraction taken by an ophthalmologist. They were all accurate, Dr. Binder says.
- The four aberrometers were tested on a model eye with known higher-order aberrations. The best repeatability was achieved by the Z-View, followed by Visx, WaveLight, and Alcon, says Dr. Binder. (This study was presented at American Academy of Ophthalmology meeting last fall.)
- Thirty-nine patients were fitted with two pairs of spectacles, one with lenses prescribed on a manifest refraction, and the other with lenses prescribed by the Z-View. The patients found insignificant differences. Next, these patients will be tested on spectacle lenses

corrected for higher-order aberrations, says Dr. Binder.

Although industry experts disagree over how much impact aberrometry will have on optical dispensing in the near future, they suggest that the technology is here to stay.

“The instrument is really a type of very sophisticated autorefractor,” says Charles Campbell, a physicist who has consulted for Ophthonix and other aberrometer manufacturers. “The new wavefront analyzers are simply the next generation in making a vision-correction measurement.” Mr. Campbell says the next logical step is for aberrometers to come down in price.

Meanwhile, the question remains whether this is a good investment for your optical dispensary. Asked if he had invested in the technology, Dr. Binder said, “We probably would invest when [the prescription for] higher-order aberrations can be filled in spectacle lenses, and when the study proves that patients can notice the benefit in the lenses. Everyone wants to see better than they do, if we can make it possible.”

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