

SEEING THE EYE IN A NEW LIGHT

Novel Applications of ATLAS Corneal Topography for the Cataract Surgeon

Corneal imaging that is more than just topography.

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In cataract surgery, we can only treat the irregularities we can identify. Fortunately, diagnostic imaging for the eye is advancing impressively. Carl Zeiss Meditec, Inc. (Dublin, CA), has developed new software for its upgraded ATLAS 9000 Corneal Topography System that I think will prove quite useful for cataract surgeons. This innovation in diagnostic corneal imaging combines the readings from the ATLAS 9000 with mapping information from the Visante OCT (also from Carl Zeiss Meditec, Inc.) to provide a comprehensive view of the eye. I call this combination *ATLAS corneal imaging*, because it is more than just topography.

MYRIAD BENEFITS

Meeting Higher Expectations

Routinely performing corneal topography on cataract patients helps us assess the effect of corneal aberrations—whether lower- or higher-order, and including cylinder, irregular, or asymmetric—on patients' visual outcomes. The ability to preoperatively discern certain corneal pathologies and more accurately select IOL

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implants is especially important for premium IOL patients, who expect excellent postoperative results. Technology such as the ATLAS 9000 system will help us meet their expectations.

Ocular Alignment for Mapping

One of the issues we surgeons have with any scanning technology, whether it is used in the anterior or posterior segment, is reproducibly achieving proper alignment with the eye's axes to ensure reliable mapping. The ATLAS 9000 and Visante OCT have new features to improve this function. When conducting topographical mapping, we are used to working with a variety of curvature maps, such as axial, tangential, and mean curvature. These same data maps can be developed from simulated keratometry and videokeratometry and evaluated with a topographical device.

Astigmatism Management

The use of corneal topography in astigmatic treatments, whether using lenticular or corneal methods, is a somewhat new area of diagnosis that is generating great interest. As cataract and refractive surgeons implant more premium IOLs, it is becoming increasingly important to manage astigmatism. Corneal curvature maps

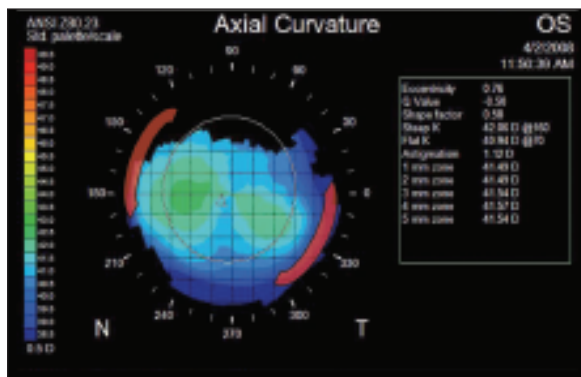


Figure 1. An eye with mild against-the-rule cylinder.

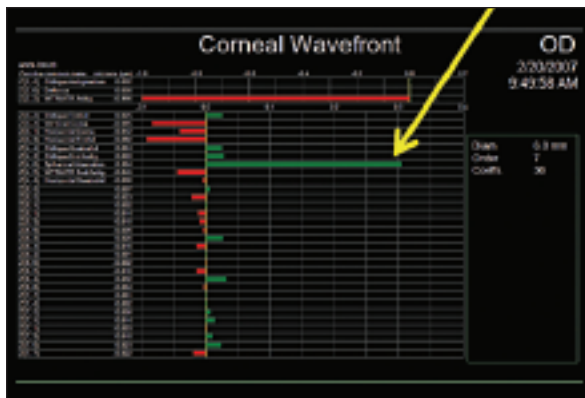


Figure 2. A Zernike analysis of the corneal wavefront shows the patient's corneal spherical aberration (arrow).

can be quite helpful for surgeons to plan the placement of limbal relaxing incisions and toric IOLs along the appropriate axis. For example, Figure 1 shows a patient with a little bit of against-the-rule cylinder. The surgeon could choose to make two limbal relaxing incisions to flatten the steep axis, or he may decide to place a toric IOL in an equal but opposite power.

Corneal Aberrations

The new ATLAS 9000 software offers several diagnostic features that provide additional information about corneal aberrations. One particularly advantageous function is image simulation, which shows patients an example of how an eye chart may appear to them under the influence of their corneal aberration. This application also helps surgeons to explain why patients may still not see clearly after cataract surgery and why they may need additional treatment to correct certain aberrations.

The software's modulation transfer function and Zernike analysis can be used to further customize IOL technology. With three choices of aspheric IOLs available (the Tecnis [Advanced Medical Optics, Inc., Santa Ana, CA], the AcrySof IQ [Alcon Laboratories, Inc., Fort Worth, TX], and the Sofport AO [Bausch & Lomb, Rochester, NY]), how can we select the most appropriate lens for the patient? The ATLAS gives us the ability to determine corneal spherical aberration (Figure 2, arrow), which, as George Beiko, MD, found in a large population of cataract patients,¹ can vary widely. By determining the patient's specific corneal aberration, we can select the appropriate IOL to correct the entire amount or leave some residual spherical aberration, depending on the patient's visual preferences. This is how we can use the ATLAS to custom-select corrective lenses for our patients.

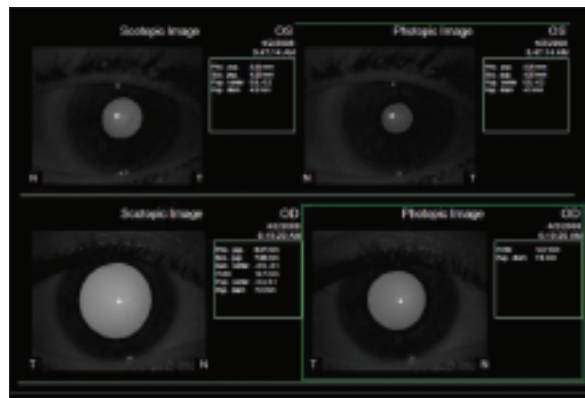


Figure 3. A sample screen shows how the ATLAS pupillometry can influence IOL selection.

Pupillometry

I find pupillometry to be increasingly important in both LASIK and cataract surgery. We know that pupil size can play a role in IOL selection. For example, pupils smaller than 2 mm may not experience sufficient near vision from refractive multifocal IOLs, and pupils that are too large may have suboptimal experiences with diffractive lenses. Larger pupils may also be at risk for dysphotopsia. Figure 3 shows scotopic and photopic imaging of the pupil with the ATLAS. Note the difference in the pupil size of two different patients under scotopic and photopic lighting. This comparison demonstrates that due to the relative size of the pupil, one particular multifocal IOL may be preferred over the other in consideration of light conditions. Obviously, the utility of this technology is very exciting.

CONCLUSIONS

As I have tried to illustrate in this overview, I see multiple potential applications for the ATLAS technologies, which I consider to be beyond corneal topography. As ophthalmologists adopt more advanced surgical techniques, we need measurements that we can trust, and I have confidence in the reliability of Carl Zeiss Meditec's devices. The use of corneal topography in managing perioperative astigmatism, the assessment of higher-order corneal aberration, aspheric IOL selection, and the use of pupillometry in multifocal IOL preference are just some of the potential uses of the ATLAS 9000 for the cataract surgeon. ■

1. Beiko GH, Haigis W, Steinmueller A. Distribution of corneal spherical aberration in a comprehensive ophthalmology practice and whether keratometry can predict aberration values. *J Cataract Refract Surg.* 2007;33(5):848-858.