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Refractive & Cataract Applications of OCT

The versatility of the Visante Omni in the ophthalmic practice.

BY AMIN ASHRAFZADEH, MD, AND ROGER F. STEINERT, MD

We first integrated the Visante OCT (Carl Zeiss Meditec, Inc., Dublin, CA) into our practices in 2006, and we have been involved in the development of versions 2.0 and 3.0 of the software. The third, most recent iteration features new software called *Omni* that integrates the Visante's anterior-segment optical coherence tomography (AS-OCT) pachymetry with corneal topography from the Humphrey ATLAS (Carl Zeiss Meditec, Inc.). The Omni software allows the Visante to incorporate information from the ATLAS topographer into its own readings to create a comprehensive picture of the cornea and anterior segment. The Visante Omni is the first device to combine optical coherence tomography (OCT) and Placido disk topography, and this article describes the utility of these devices in cataract, refractive, and glaucoma surgeries.

THE TECHNOLOGIES

Placido disk technology is the gold standard for measuring the corneal surface. The ATLAS topographer provides anterior Placido-disk topography. It features the PathFinder II Corneal Analysis Software, which is an anterior topographic program with an extensive clinical database to help surgeons identify abnormal corneal conditions such as keratoconus. The Visante OCT is one of the highest-resolution imaging devices in ophthalmology and uses a wavelength of 1,310 nm (infrared light), whereas Scheimpflug systems use a wavelength of 470 nm (blue, visible light). Thus, the Visante is able to capture ocular structures that other devices cannot, such as through the sclera, the complete anterior angle, as well as fine details of scars and other corneal irregularities.

The V-Trac Registration System links the Visante OCT pachymetry and the ATLAS topographer and provides

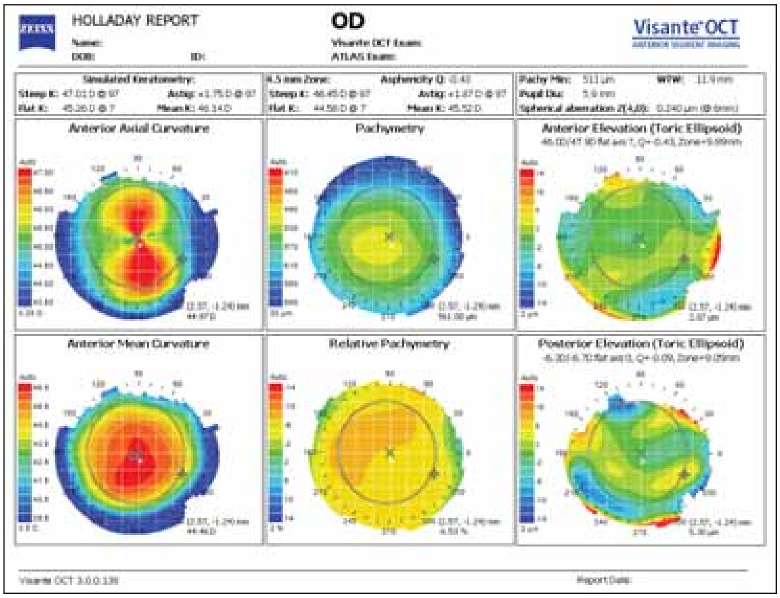

Figure 1. This Holladay report shows the right eye's imported anterior surface images from the ATLAS 9000. The map displays anterior curvature, pachymetry, anterior elevation (toric ellipsoid), anterior mean curvature, relative pachymetry, and posterior elevation (toric ellipsoid) maps. The global pachymetry map provides 2,048 pachymetric data points. In the relative pachymetry map, each of these 2,048 measurement points are compared to the median thickness of a typical cornea, and the percentage of deviation is presented for comparison. The posterior elevation (toric ellipsoid) map is now mathematically derived from the ATLAS' anterior elevation map and the pachymetric map from the Visante AS-OCT. The map is normal and shows the highest point of elevation to be a nominal 5.30 µm.

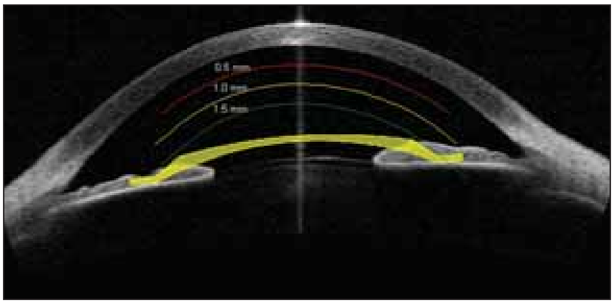

Figure 2. An enhanced anterior segment image of the eye with the rainbow tool (thin lines) and phakic IOL (in yellow) tools activated. The rainbow tool shows the clearance distance from the endothelium and also helps guide the centration of the phakic IOL. If the IOL is perfectly placed, its edges have more than 1.50 mm of clearance.

precise alignment of the corneal vertex to generate reliable posterior topography.

The Holladay Report (Holladay Consulting, Inc., Bellaire, TX) conveniently displays anterior axial curvature, anterior mean curvature, absolute pachymetry, relative pachymetry, and anterior and posterior elevation on one screen for evaluation and surgical planning. It also provides key corneal data such as simulated keratometry, asphericity Q, white-to-white measurements, and spherical aberration Z(4,0).

CASE EXAMPLE—DR. ASHRAFZADEH

A 42-year-old female presented to my practice with a refraction of -11.00 -2.75 X 021 = 20/30 OD and -9.75 -3.75 X 176 = 20/25 OS. Her pachymetry was 556 µm OD and 550 µm OS, which although reasonable, was not enough for LASIK surgery given her refraction. A screen shot from the ATLAS 9000 shows the Holladay reports for the right eye (Figure 1).

I knew that with this patient's prescription, I would have to implant a Verisyse phakic lens (Abbott Medical Optics Inc., Santa Ana, CA). Again, I used the Visante to measure the amount of space available for the implant; the device lets you virtually test various IOL sizes for the best fit. (Incidentally, the VariCalc IOL calculation software [Abbott Medical Optics, Inc.] overestimated the endothelial clearance for the IOL's implantation.)

First, I created an enhanced image of the anterior segment and used the rainbow tool to see the amount of clearance from the endothelium (Figure 2, thin lines). Then, I activated the system's Refractive Software module (Figure 2, yellow) to simulate preoperatively the proper placement of the Verisyse in the anterior chamber. There was not enough room for a 6-mm, -12.00 D implant, but a 5-mm, -12.00 D lens was too small given her pupil size. Next, I selected a 6-mm, -10.00 D Verisyse phakic lens, which still did not show sufficient endothelial clearance. I then tried a 6-mm, -7.00 D Verisyse IOL. I used the chamber measurement tool to determine the crystalline lens rise (Figure 3, purple) and the vault tool to calculate the distance between the posterior side of the implant and the anterior surface of the crystalline lens (Figure 3, orange). The device's rainbow tool helped me determine the proper centration for the Verisyse implant.

The Visante's IOL simulation tools give the surgeon an unparalleled degree of safety for IOL implantation. Figure 4 shows the Visante's OCT image of the patient's right eye postoperatively and demonstrates how precisely the device can predict the outcome of the surgery. Note that there is 1.60 mm of endothelial clearance, which is exactly what was suggested in the preoperative calculations.

Six weeks after implanting the patient's second eye with a Verisyse phakic lens, I treated her remaining refractive error with iLASIK using the Star S4 CustomVue platform with Iris Registration (Abbott Medical Optics Inc.). I employed the Visante and ATLAS machines again to determine the appropriate depth of the femtosecond flap cuts and excimer ablation. The IntraLase flaps (Abbott Medical Optics Inc.) are visible in Figure 4 (to the immediate right of the left endothelial marker). The slit-lamp image in Figure 5 shows the clinical image of the eye postoperatively.

ADDITIONAL APPLICATIONS

The Visante OCT with the Omni software is not just a refractive tool. It allows surgeons to image the angles of the anterior chamber very clearly and to see the true opening of an angle. We have been able to evaluate many eyes that have very narrow angles. The Visante OCT also aids surgeons in planning lamellar keratoplasty. One cannot perform this procedure without knowing how deep to cut, and only OCT technology can supply this information. With the ATLAS topographer, practitioners can see the thickness and

Figure 3. The final model of the eye as shown on the Visante Omni, which took the author less than 3 minutes to create, shows the phakic IOL model in yellow, the endothelial clearance tools in purple, and the vault tools in orange.

Figure 4. The postoperative Visante Omni image of the right eye shows 1.60 mm of endothelial clearance, exactly as the device calculated preoperatively.

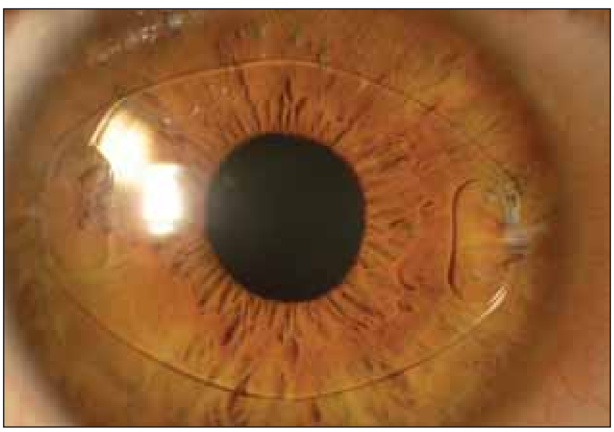

Figure 5. The patient's eye as viewed at the slit lamp after the phakic IOL implantation.

depth of corneal scars and even evaluate corneas that have undergone Descemet's stripping automated endothelial keratoplasty. Now that the Omni software allows the Visante to import the calculations from the ATLAS topographer, it is possible to obtain a complete picture of the eye. In contrast, we feel that Scheimpflug devices do not allow the physician to see the angle, are unreliable in reading anterior chamber depth, and do not image and measure corneal irregularities such as scars or image IOLs.

The Visante OCT and ATLAS devices have also enabled us to treat more patients by obtaining precise calculations for challenging eyes (both refractive and cataract) and identifying underlying pathologies. Thus, we can provide better service to our patients and also increase the number of patients we treat for refractive surgery.

Although many surgeons primarily use the Visante OCT for diagnosing and treating glaucoma, the device has significant applications in corneal issues. We both use the Visante extensively for refractive applications, although we cannot bill for these elective tests. Currently, the OCT anterior segment code is 0187T. This is a temporary code, which will

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become permanent as of January 1, 2011. Just like posterior-segment OCT has its own billing code (92135), the anterior segment will have its own code, and more insurance companies will cover it. The ATLAS topography has been a billable procedure for many years.

PATIENT EDUCATION

Before the Visante OCT, it was difficult to explain to patients, in abstract terms, that they had a narrow angle and why they should undergo a peripheral iridotomy. Now, surgeons can capture and print out a Visante image in about 1 minute and show the patient what they are describing. Thus, the Visante saves an enormous amount of chair time in addition to enabling surgeons to provide a much more accurate measurement for the patient. We both have had patients referred from other practitioners who told them they needed an iridotomy. During the consultation, we can look at these patients' eyes on the Visante and show them whether they have narrow angles. Then, they can take the printout back to their primary ophthalmologist and either undergo the treatment or demonstrate that it is not necessary.

CONFIDENCE IN RESULTS

With the Visante and ATLAS devices, we achieve precise results and feel confident about our outcomes. We know that our treatments will be safe and effective. These devices take surgical planning out of the realm of qualitative measurements and put it into the realm of quantitative measurements. For more case examples, please visit www.askdrash.com. ◆

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