SPONSORED CONTENT

Welcome to this quarterly edition of reports sponsored by the Cornea, Contact Lenses, and Refractive Technologies (CCLRT) Section of the American Academy of Optometry.

AMERICAN ACADEMY of OPTOMETRY
SECTION ON CORNEA, CONTACT LENSES & REFRACTIVE TECHNOLOGIES

We hope you will find these reports informational and that you'll pick up some clinical pearls to utilize in your daily practices. We also hope that you get to know some of our featured Diplomate members who have already made the lifelong commitment to learning in this field. Additionally, we encourage every *Contact Lens Spectrum* reader to consider becoming a Diplomate of the CCLRT; clinician or researcher, we welcome your membership. **For further information: aaopt.org/CCLRT.**

—Randall Sakamoto, OD, PhD, FAAO
Diplomate, CCLRT

Technical Innovations in Refractive Surgery

BY PHILLIP B. BRUNSON, OD, FAAO
DIPLOMATE, CCLRT

In the continued quest to improve refractive surgical outcomes, topographical directed LASIK represents the latest innovation in this endeavor. I would like to discuss this new technology and how it can benefit patients and their surgical outcomes.

In November of 2015, Alcon gained FDA approval for Contoura® Vision topography-guided LASIK. Subsequently, Contoura was launched into practice in the United States market during 2017. Since that time, it has gradually evolved into a prominent treatment strategy for qualifying patients. Initially, it was thought that topography-guided ablations would solely be utilized for those patients with topographic abnormalities. Impressively, the Contoura FDA clinical trials yielded 92.6% of eyes achieving 20/20 or better, 64.8% of eyes achieving 20/16 or better, and 34.4% of eyes achieving 20/12.5 or better visual acuities.[1] It was also concluded that Contoura treatments resulted in lower rates of side effects associated with LASIK, such as light sensitivity, night driving problems, reading difficulty, glare, halos, and starbursts.[1]

Based on the postoperative visual acuities and the improved quality of vision, it was assumed that topography-guided LASIK would immediately gain a significant market share in the United States as a leading treatment option for qualifying LASIK patients. However, several surgical centers struggled to gain a comfort level with implementing it as a primary treatment strategy.

The Diagnostics

An essential component to performing Contoura laser vision correction involves the WaveLight® Topolyzer™ Vario diagnostic device. It is a placido-based topographer that intricately images 22,000 corneal contour points for each eye's treatment. In addition to measuring corneal topography, the Vario imaging device allows for iris registration to account for cyclotorsion during the surgical procedure and centration of the refractive treatment over the corneal apex versus the center of the pupil.

Cyclotorsion commonly occurs when patients transition from an upright position (typical for preoperative measurements) to a supine position during surgery. Patient eyes

Figure 1. Seven topographical Vario images of a patient's right eye sent for treatment planning via the Alcon WaveNet system.

can rotate by up to 14 degrees when supine during laser vision correction, though the average is 2–3 degrees.[2,3] The pupil center can be in different positions under varying illumination conditions, and pupil decentration has also been reported to occur intraoperatively.[4]

Current FDA approval for Contoura LASIK candidacy includes treatments up to -8.00 D sphere, up to -3.00 D cylinder, and a spherical equivalent no greater than -9.00 D.[1] Even those patients with low refractive errors benefit from Contoura LASIK, because everyone has some degree of corneal topographic irregularity that can hinder visual performance.

The Measurements

In order to capture quality topographical scans with adequate data points for laser vision correction, staff training for the Vario imaging device is vital. We prioritize capturing the Vario measurements prior to any other scanning technologies or testing being performed as an attempt to prevent disruption or distortion of the patient's tear layer. Our technicians verify that patients maintain a comfortable body position prior to acquiring images to ensure that they

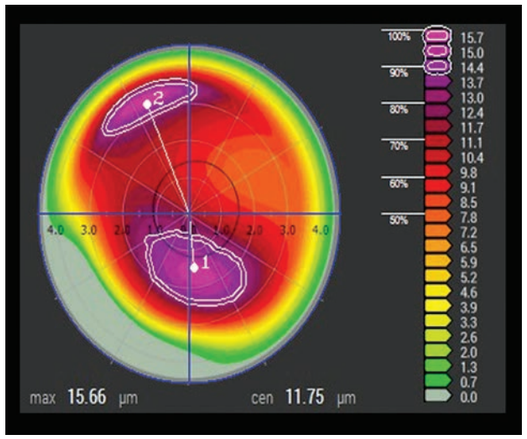

Figure 2. Phorcides topography analysis.

can appropriately remain stationary for each image capture to reduce variability between scans. Proper head positioning and eye fixation will enhance the ability to acquire corneal data points in a repeatable fashion.

We attempt to capture 6 to 8 high-quality images per eye. Once the captured scans have been verified for quality and comparability, the images are then transmitted to the planning station via the closed WaveNet™ network for further evaluation for inclusion or exclusion for the Contoura LASIK surgical plan (Figure 1).

Planning Treatment

The largest challenge that we confronted in implementing Contoura laser vision correction regarded how to utilize and surgically plan a refractive treatment encompassing the information provided by corneal topographical data and manifest refraction when the magnitude and/or axis of cylinder correction were different. The correction of the topographical higher-order aberrations will also have an effect on the spherical and astigmatic refractive outcomes.

Eyes in the original FDA study for Contoura approval were restricted to only include treatments with differences between the measured topographical axis of astigmatism and the manifest refraction axis of astigmatism of only 10 degrees if greater than 2 D of astigmatism was present.[1] If less than 1.75 D of astigmatism, they could differ by more than 10 degrees.[1] The inclusion criteria also included that the magnitude of astigmatism could only differ between topography and manifest refraction of 0.75 D.[1]

Several of our preoperative patient measurements would vary between topographical measurements and manifest refractions greater than the values utilized in the FDA trial. Consequently, we would often refrain from performing Contoura LASIK and utilize a Wavefront-optimized treatment merely because we were apprehensive of obtaining an undesirable refractive surprise or outcome. Initially, less than 10% of our LASIK patients were receiving topography-based treatments simply because of a lack of faith in treatment planning.

Topography-guided ablation continued to evolve with the addition of a clinical decision support software. Our surgical center was invited in 2018 by Dr. Mark Lobanoff to serve as a testing site for his innovative planning program, known as the Phorcides Analytic Engine or simply Phorcides, to facilitate answering so many of these Contoura treatment-related conundrums.

It utilizes GIS (geographic imaging software) to analyze the two-dimensional corneal topographic treatment image produced by the Alcon Contoura planning laptop and extracts detailed information about the complex three-dimensional cornea from it.

The software then compiles a series of refractive vectors: one vector for each raised topographic feature on the corneal surface, one vector for the anterior corneal astigmatism, one vector for the posterior corneal astigmatism, and one vector for any internal lenticular astigmatism. (Figure 2). Finally, it uses a series of advanced computer algorithms to determine the best treatment for each eye.

Outcomes

The Phorcides Analytic Engine improved our surgical outcomes and provided an objective approach to deriving surgical treatments. Our own personal retrospective review of clinical records compared the 90-day postoperative results of 115 eyes that received topographical LASIK treatments utilizing the Phorcides Analytic Engine for treatment planning and 133 eyes that received topographical LASIK treatments utilizing the manifest refraction for treatment planning. Significantly more eyes in the Phorcides group had a postoperative uncorrected distance visual acuity of 20/15 or better while more eyes in the Manifest Refraction group had a postoperative uncorrected distance acuity of 20/25 or worse (13/133 in the manifest group vs. 1/115 in the Phorcides group).[5]

The Contoura topography-guided laser vision correction options coupled with the Phorcides Analytic Engine planning software have produced some of the most astonishing LASIK vision results published to date.[6] We have been pleased with our postoperative outcomes regarding uncorrected visual acuities and patient satisfaction concerning quality of vision. Since adopting the objective approach of the Phorcides Analytic Engine, we have confidently converted to Contoura as our preferred treatment for all qualifying eyes. ■

REFERENCES

1. FDA Clinical Trials. Allegretto Wave Eye-Q Addendum Procedure Manual T-CAT Topography-Guided Treatments. Available at http://www.accessdata.fda.gov/cdrh_docs/pdf2/P020050S012d.pdf, last accessed Dec 10, 2020..
2. Chang J. J Cataract Refract Surg. 2008;34(10):1720-1726.
3. Febbraro J-L, et al. J Cataract Refract Surg. 2010;36 (10):1718-1723.
4. Yang Y, et al. Invest Ophthalmol Vis Sci. 2002;43(7):2508-2512.
5. Brunson PB, Mann PM II, Mann PM, Potvin R. Clin Ophthalmol. 2020;14:3975-3982.
6. Stonecipher K. Topography guided laser outcomes using a new vector software program (Phorcides). Paper presented at: the ESCRS Annual Meeting; Sept. 14-18, 2019; Paris.

Dr. Brunson has been a member of the Mann Eye Institute and Laser Centers medical team since 2003, and currently serves as the clinical director of refractive surgery. He is a Fellow and a Diplomate of the American Academy of Optometry section of Cornea, Contact Lens, and Refractive Technologies (CCLRT) as well as a board-certified Diplomate of the American Board of Optometry. He may be reached at pbrunson@manneye.com.