Wavefront Optimized vs. Topography-Guided Corneal Ablations with WAVELIGHT Platform: A Summary of Visual Outcomes

INTRODUCTION
Two corneal refractive ablation procedures that have been widely adopted and compared are wavefront optimized (WFO) treatments and topography-guided treatments. Some surgeons have generally preferred the ease of WFO compared to newer, more advanced laser refractive treatment options, and while WFO generally provides good vision for most patients, topography-guided ablation has shown visual acuity advantages. The WAVELIGHT Excimer Laser Platform (Alcon) was originally approved for WFO treatments and was later approved for use for topography-guided treatments.

VISUAL OUTCOMES
The prospective FDA study on normal eyes showed excellent visual outcomes after CONTOURA Vision (Alcon), with uncorrected distance visual acuity (UDVA) of 20/20 or better in 92.6% of eyes, 20/16 or better in 64.8% of eyes, 20/12.5 or better in 34.4% of eyes, and 20/10 or better in 15.7% of eyes (at 12 months) (Figure 1). These results were achieved when the manifest refraction was used, as well as in eyes where the difference between the topographic astigmatism and manifest refractive cylinder were nominal. Additionally, 30.9% of eyes gained one or more lines of UDVA compared with preoperative corrected distance visual acuity (CDVA). Visual acuity improvement from 3 to 12 months was also shown.

Study results listed below include only those studies where CONTOURA Vision was used consistently with the approved FDA indications for use, the manifest refraction was used for the surgical planning, and 20/15 visual outcomes were provided. In general, all treatments were equally effective at the 20/20 level, but differences at 20/15 and 20/10 were shown. Additionally, residual refractive error among all treatments was similar across the studies mentioned unless stated otherwise.

WFO VS TOPOGRAPHY-GUIDED ABLATION
Stonecipher et al conducted a large prospective study on 846 eyes comparing WFO (n = 430) to topography-guided CONTOURA Vision (n = 416) using manifest refraction for treatment planning (Figure 2). The study showed that more patients achieved better than 20/20 vision with CONTOURA Vision than with WFO: 54.6% versus 45.0% had UDVA of 20/15 or better. These visual acuity percentages did not reach the levels seen in the FDA study. However, this study included all
patients with normal corneal parameters and was not restricted by differences in corneal and refractive astigmatism, as was the case in the FDA study. They also found in this study that the postoperative spherical equivalent refraction and the residual cylinder were slightly worse in the wavefront-optimized group.

One study by Kim et al showed that the number of patients with postoperative UDVA was numerically higher at 20/16 with WFO (versus CONTOURA Vision); however, this difference was reported as not statistically significant. The study also showed that topography-guided LASIK with CONTOURA Vision induced fewer total corneal HOAs ($P = .013$) and less coma ($P = .003$). Notably, this study was substantially smaller ($n = 86$ eyes) than the other studies reported here.

**CONTOURA VISION: MANIFEST REFRACTION VERSUS PHORCIDES**

Several retrospective analyses on CONTOURA Vision using manifest refraction versus the PHORCIDES Analytic Engine software (Alcon) for treatment planning have recently been published. These studies show that the two treatment profiles are equivalent at 20/20. However, more patients are able to achieve 20/15 and 20/10 acuities with the use of PHORCIDES. Lobanoff et al showed that a significantly higher percentage of patients reached 20/16 vision with PHORCIDES ($n = 323$ eyes) versus manifest refraction-based ($n = 317$ eyes) CONTOURA Vision (62.5% vs. 41.3%; $P < .001$). The number of patients in this study with UDVA better than their preoperative CDVA was significantly higher in the PHORCIDES group (36.5% vs. 23.0%; $P < .001$), and significantly more eyes in the PHORCIDES group gained 1 or more lines of CDVA (42.7% vs. 30.3%; $P = .001$). Importantly, these studies showed 20/20, 20/15, and 20/10 results that are very similar to the percentages in the FDA study results, which selected for eyes with tight agreement between the manifest astigmatism and the measured anterior corneal astigmatism, whereas these studies were not selective in this way and better represented the true clinical population.

In addition to the studies already presented, there are several publications by Wallerstein et al and others using a manifest refraction-based nomogram that also show that CONTOURA Vision treatment can be highly effective. However, these studies did not provide direct head-to-head comparisons of their approaches to either WFO or PHORCIDES.

**WHICH TREATMENT IS RIGHT?**

WAVELIGHT WFO and CONTOURA Vision treatments both provide excellent visual outcomes especially at the 20/20 level. While both treatments can also deliver 20/15 visual acuity, CONTOURA Vision has shown, overall, that a higher number of patients can achieve 20/15 or better. Further, the use of the PHORCIDES Analytic Engine software has consistently delivered higher percentages of 20/15 over the standard manifest refraction-based CONTOURA Vision planning, even in patients whose manifest and topography astigmatism do not match.

While CONTOURA Vision has the potential for better visual outcomes and has been used successfully on a wide range of patients, there are a few instances where WFO treatments would be preferred.

1. When several high-quality topography images are not obtainable, as this will limit the ability to accurately define the anterior corneal elevations.
2. When the clinical refraction is outside of the FDA-approved parameters for CONTOURA Vision (e.g. Hyperopia, myopia > -8.00 D, cylinder > 3.00 D, MRSE > -9.00 D)

**CONCLUSION**

WFO treatments and CONTOURA
Vision are both effective at the 20/20 level, however, CONTOURA Vision, and specifically the use of the PHORCIDES Analytic Engine software, can provide even better visual outcomes overall, with more patients reaching 20/15 and 20/10. The PHORCIDES software helps surgeons appreciate the subjective nature of determining the right balance of cylinder magnitude and axis and when manually planning CONTOURA Vision treatments, it provides a new objective, user-friendly approach that makes it more appealing to surgeons.

3. Stonestreet KG, Kozina GA, Stonestreet M. LASIK for -6.00 to -12.00 D of myopia with up to -5.00 D of astigmatism using the ALLEGRO WAVE: 4-year results with the 200- and 400-hz platforms. J Refract Surg. 2010;26(1):518.