Correcting aberrated corneas remains difficult despite the widespread availability of wavefront-guided treatment. Topography-guided ablation is an alternative for patients with a poor quality of vision due to complications following keratorefractive surgery, asymmetric astigmatism, and keratoconus.1-4 During the past few years, we have performed almost 600 topography-guided laser treatments with the Allegretto Wave T-CAT software (not available in the US; Wavelight, Inc., Sterling, VA). The goal of these treatments is twofold. First and foremost, we want to improve patients’ BSCVA. Second, we want to improve their unaided distance acuity, which is the reason many of them underwent refractive surgery originally.

**METHOD**

The Allegretto Wave excimer laser platform uses the Allegro Topolyzer for T-CAT treatment (all products from Wavelight, Inc.). Planning the treatment is complex, because the surgeon must make adjustments for anticipated induced refractive changes. Each case requires customization, and patients must have realistic expectations.

**WAVEFRONT- OR TOPOGRAPHY-GUIDED ABLATION?**

Wavefront-guided customized treatment assumes that most of a given patient’s ocular aberrations can be corrected by reshaping the cornea. Patients may have normal topographies yet abnormal wavefront maps (Figure 1). In this situation, a wavefront-guided treatment might induce aberrations. When a patient’s corneal aberrations correlate with his wavefront aberrations, either a wavefront- or topography-guided approach should yield satisfactory results.

**CHOOSING A TOPOGRAPHY-BASED TREATMENT**

**Indications**

The ablation profile is calculated based on the topographical height maps, which are then adjusted based on the eye’s overall refraction. The greatest potential for topography-guided treatment may be in severely aberrated corneas with decreased BCVA for which even refraction is unreliable and wavefront capture is not possible. In these situations, we use the T-CAT software and advise patients that they may require a second procedure.
for successful refractive outcomes.

The indications for topography-guided treatment include decentered ablations, the enlargement of the optical zone, irregular astigmatism following penetrating keratoplasty, RK, asymmetrical astigmatism, and keratoconus. We increasingly prefer PRK with mitomycin C (MMC) rather than LASIK, because the former spares tissue in eyes with thin corneas—often an issue after laser refractive surgery—and retreatments are easier. In such cases, we favor a transepithelial approach.

**Contraindications**

Topography-guided ablation only uses data from the anterior corneal surface. It is therefore probably inadvisable to perform topography-guided ablation when the patient’s manifest refraction is not consistent with the measurement obtained by the Allegro Topolyzer. This approach is also contraindicated when the topographic astigmatism does not correlate with the manifest refraction or a deep ablation is required in an eye with a thin cornea.

**Enlarging the optical zone**

Topography-guided LASIK or PRK can readily treat the symptoms of halos and glare, particularly at night, due to a small optical zone. In one case, for example, we increased the central monodoptric optical zone from 2.8 to 4.9mm (Figure 2). Additional concentric peripheral treatment simulated a hyperopic ablation for which we compensated with a myopic treatment calculated by the topography-guided neutralization technique and included in the initial procedure.

**Correcting decentered ablations**

Decentered ablations following laser refractive surgery require complex calculations to estimate the degree of refractive change induced by the topographical treatment. One of our patients had undergone a decentered hyperopic keratomileusis 10 years earlier and was contact lens intolerant. After MMC-assisted, topography-guided PRK using the T-CAT software, his BSCVA improved from 20/50 to 20/30 (Figure 3).

**Addressing keratoconus**

Topography-guided PRK may speed the progression of keratoconus. The procedure may have a place, however, in the treatment of highly symptomatic patients who are...
contact lens intolerant and are considering penetrating keratoplasty but are hesitant to proceed with this option. We have operated on 41 such eyes and have 1 year’s follow-up on 15. None lost more than one line of BSCVA, with predictability of 73% within 1.00D.5

TREATING ASYMMETRIC ASTIGMATISM

Most patients with irregular and asymmetric astigmatism who are undergoing keratorefractive surgery in the US are now probably treated with a wavefront-guided laser. Such was our practice until the introduction of topography-guided techniques with the Allegretto Wave T-CAT software (Figure 4). Subsequently, we switched almost all of our cases (n = 59 as of December 2006) to topography-guided ablations for their predictable outcomes and ease. Long-term studies are required to determine the indications of the two approaches.

CONCLUSION

Topography-guided ablation with the T-CAT software is a new option for patients with severely aberrated corneas. Recent reports have demonstrated the safety and efficacy of this approach at improving patients’ BSCVA, contrast sensitivity, and aberrations.6 In our experience, the more difficult cases involve patients with highly irregular corneas from previous photorefractive surgery. We usually elect to proceed with PRK but must educate patients that they are likely to require a retreatment to resolve residual lower-order ametropia. Each case requires an individualized approach, and the development of nomograms is difficult. Refinements of the technique will improve its predictability and minimize the need for retreatments.

Simon Holland, MB, FRCSC, serves in the Department of Ophthalmology for the University of British Columbia, and he is in private practice at Pacific Laser Eye Centre in Vancouver, British Columbia, Canada. He acknowledged no financial interest in the products or company mentioned herein. Dr. Holland may be reached at (604) 875-5850; simon_holland@telus.net.

David T. C. Lin, MD, FRCSC, is Clinical Assistant Professor of Ophthalmology at the University of British Columbia and is Medical Director of the Pacific Laser Eye Centre in Vancouver, British Columbia, Canada. He has received travel reimbursement from Wavelight, Inc. Dr. Lin may be reached at (604) 736-2625.

5. Holland SP, Lin D. Topographically-directed PRK for irregular astigmatism following penetrating keratoplasty. Poster presented at: The 2006 AAO Annual Meeting; November 13-14, 2006; Las Vegas, NV.