

# Refractive Correction With C-TEN

This treatment offers a unique approach to surface ablation.

BY ISAAK SCHIPPER, MD; AND URS THOMANN, MD

LASIK and femto-LASIK are popular methods in refractive surgery, but many surgeons, including those on our team, perform surface ablation for safety reasons. Some surgeons prefer PRK, LASEK, or epi-LASIK. Unfortunately, our experience with these methods was not as good as has been documented in the literature. Therefore, we perform a new approach to surface ablation, customized transepithelial no-contact (C-TEN) ablation.

C-TEN is an all-laser, no-touch surgical procedure to correct refractive errors. This strategy eliminates the aberrations that are frequently induced by microkeratomes and femtosecond lasers, an element crucial to optimizing the results of custom refractive surgery. C-TEN is performed with the iRES dual-system 1,000-Hz excimer laser (i-Vis technologies, Taranto, Italy).

## PROCEDURE

Preoperatively, two topography maps are acquired using the Preciso corneal topographer (i-Vis technologies) and accepted only when all 39,000 measured points are congruent in two measurements within no more than 3  $\mu\text{m}$ . Dynamic pupillometry is then performed under different lighting conditions, and the minimal ablation zone is defined to avoid blending and halos. Refractive, topographic, and pupillometric data are entered into the computer so that the customized interactive programmed topographic ablation (CIPTA; Figure 1) software can calculate the topography-assisted treatment, the individualized transition zone, and the ablation diameter. The treatment and the transition zones can be changed manually if necessary. The default epithelial thickness is 65  $\mu\text{m}$ .

After applying two drops of topical anesthetic, the eye speculum is inserted. The cornea is dried with a damp sponge, and the patient is asked to look at the fixation light. Iris recognition takes approximately 5 to 10 seconds, and the treatment lasts 30 seconds for a patient with a 6-mm optical zone who is receiving 6.00 D of correction. A cooled sponge dipped in diclofenac is placed on the cornea for 30 seconds. The eye is then rinsed with balanced saline solution, a bandage silicone contact lens is placed, and steroids



Figure 1. The CIPTA ablation program is presented on the monitor of the iRES excimer laser.

and antibiotic eye drops are applied.

The postoperative course is no different from that of other surface ablation methods. The silicone contact lens remains on the eye for 4 days, and antibiotics and NSAIDs are applied. Topical fluorometholone and lubricating eye drops are prescribed for 3 months.

## RESULTS

Wound healing should occur within 2 to 3 days, but it may take as long as 4 or 5 days. Inflammation is seldom seen; most eyes show no signs of inflammation even on the first postoperative day (Figure 2). In our experience, 80% of patients said that they felt no pain or reported only a slight to moderate burning sensation. Twenty percent of patients complained about pain in the first 3 days.

After C-TEN, visual acuity improves slowly. In a review of 850 patients in our practice with preoperative myopia ranging from -0.50 to -12.00 D (mean, -4.35 D), on average, the distance BCVA at 1 week postoperative was 20/30 (range, 20/60 to 20/25). No eye lost more than 1 line of BCVA. After 2 weeks, most patients' BCVA is 20/25 or better; however, visual recovery in patients with dry eyes may take longer. This symptom occurs in approximately 30% of cases but lasts

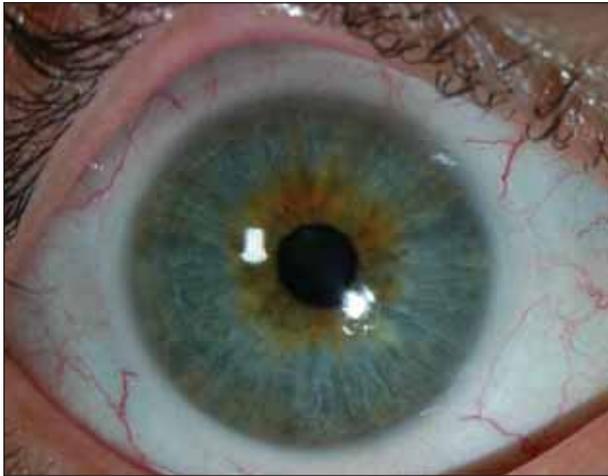


Figure 2. Appearance of an eye 1 day after C-TEN treatment; there are no signs of inflammation.

only 1 to 4 weeks. Few eyes require intensive lubricating therapy after C-TEN. Additionally, regression seldom occurs. After 3 months, mean UCVA was 20/25.

In comparison with LASIK, C-TEN has the advantage of safety, avoiding flap complications. Additionally, in comparison with other methods of surface ablation, the treatment is atraumatic because it is no-touch; the removal of the epithelial surface is minimal, corresponding to the treatment zone; the treated surface is extremely smooth; and every treatment is topography-assisted, improving visual quality and avoiding regression.

C-TEN can be used to treat high myopia (up to -12.00 D), high astigmatism (up to 8.00 D or more), and irregular astigmatism. In a recent study we will present later this year at the Swiss Ophthalmological Society meeting, we found a reduction of stray light in a group of patients who underwent C-TEN treatment for myopia. Refractive results, predictability, and safety were similar to results reported with other surface ablation treatments.

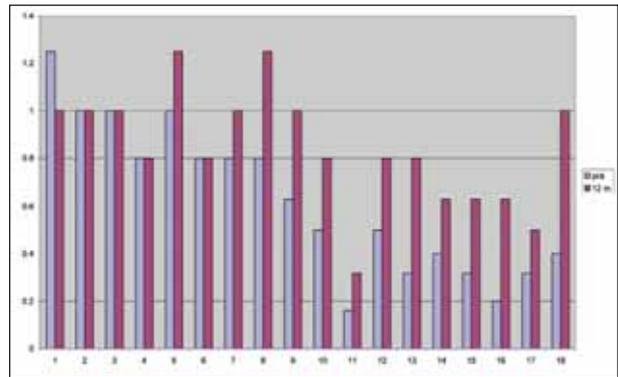


Figure 3. At 1 year, distance BCVA improved in 13 of 18 eyes with irregular astigmatism.

**IRREGULAR ASTIGMATISM**

We performed C-TEN in 57 eyes with irregular astigmatism and no corneal opacities.<sup>1</sup> Of the 18 eyes available for 1-year follow-up, 70% achieved a significant improvement in visual acuity, which was better than after 3 months. These results demonstrate that recovery of visual acuity improves during the first 12 months postoperative (Figure 3). Refractive results may not be as good as in eyes with normal corneas, but enhancement can be performed if necessary. Many patients are happy with what they describe as a more quiet and agreeable image. Two case reports are outlined in Figures 4 and 5.

**SUMMARY**

We prefer surface ablation to LASIK; C-TEN is a surface ablation treatment that boasts satisfactory patient comfort, quick healing, and in most cases the absence of pain, as well as minimal problems with haze. Additionally, our experience has shown regression only rarely. High refractive errors (myopia up to 12.00 D and astigmatism up to 8.00 D or more) can be treated safely and successfully.

The quality of vision postoperatively is, thanks to the topography-assisted treatment, very good. It is now possible

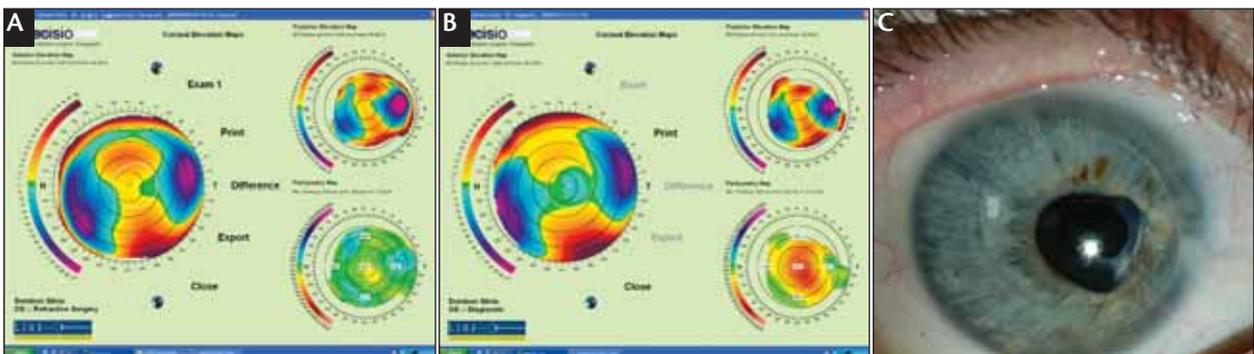


Figure 4. (A) Topography of the right eye of a 60-year-old man 5 years after penetrating keratoplasty for corneal perforation (UCVA, 20/400; BCVA, 20/50). (B) Topography of the same eye 3 months postoperative. (UCVA, 20/30; BCVA, 20/25). (C) Same eye 3 months after C-TEN with mitomycin-C (ablation depth, 133 µm).

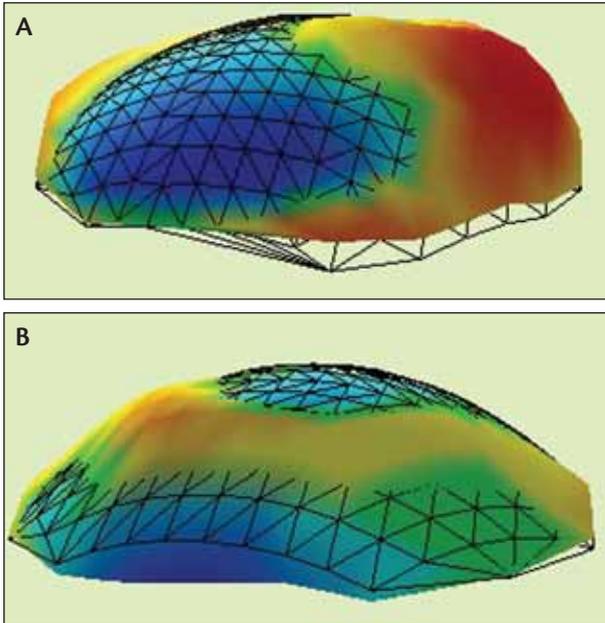


Figure 5. 3-D illustration of corneal topography (A) before and (B) after C-TEN treatment in a 40-year-old man with flap folds after LASIK. His BCVA before treatment was 20/30 with shadow; after treatment, it was 20/20 without shadow.

**TAKE-HOME MESSAGE**

- Customized transepithelial no-contact ablation is an all-laser alternative to LASIK and other surface ablation techniques.
- Wound healing normally occurs within 2 to 3 days.
- Visual acuity improves slowly after treatment.

to treat patients with high irregular astigmatism, especially those with contact lens intolerance. We can now offer these patients better vision. ■

*Isaak Schipper, MD, is Head of the Refractive Department, Eye Clinic, Kantonsspital Luzern, Switzerland, Augenlaserzentrum Zentralschweiz. Dr. Schipper states that he has no financial interest in the products or companies mentioned. He may be reached at tel: +41 41 205 3417; fax: +41 41 205 3361; e-mail: isaak.schipper@ksl.ch.*

*Urs Thomann, MD, practices at Willisau, Augentagesklinik Sursee, Augenlaserzentrum Zentralschweiz. Dr. Thomann states that he has no financial interest in the products or companies mentioned.*

1. Schipper I, Thiel M, Thomann U. Topography assisted treatment of irregular astigmatism with cTEN (a customised, transepithelial, no-touch, surgical strategy). Paper presented at: ESCRS Meeting; September 14, 2009; Barcelona, Spain.

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