Integrity of Intrastromal Arcuate Keratotomies Performed by Femtosecond Laser

To the Editor:

Femtosecond laser platforms used for cataract surgery are integrated with anterior-segment optical coherence tomography (AS-OCT), allowing for real-time imaging and measurement of the cornea, possibly leading to more precise arcuate keratotomies. The femtosecond laser permits creation of either anterior penetrating incisions or intrastromal incisions. The advantages of intrastromal incisions are less risk of infection and possible preservation of corneal nerves. Isolated case reports have described incidents of microperforations, full perforation, or vertical gas breakthrough after clear corneal incisions and arcuate keratotomy with femtosecond lasers.

A video review was undertaken for patients undergoing femtosecond laser-assisted cataract surgery with placement of a monofocal non-toric intraocular lens using an OCT-guided femtosecond laser (Catalys; Abbott Medical Optics, Abbott Park, IL) by one surgeon at Surgisite, Boston, Massachusetts. Data were analyzed in such a manner that patients could not be identified directly or through identifiers linked to the patients. The study was hence exempt from human subjects regulations and did not require review by an institutional review board. Review of the videotaped procedures was performed by two observers. All incisions were set within 0.5 mm of the limbus with 20% of the cornea left uncut anteriorly and posteriorly. A microperforation was defined by the appearance of one or more air bubbles either at the epithelial layer or into the overlying liquid interface (Figure 1).

Twenty-eight consecutive eyes of 25 patients who underwent planned intrastromal limbal relaxing incisions were reviewed; 64.9% (n = 19) of eyes underwent one limbal relaxing incision and 32.1% (n = 9) underwent two limbal relaxing incisions. Nine incisions showed no signs of microperforations, 17 eyes showed microperforation of one incision, and 2 eyes had microperforations of both planned incisions. No eyes experienced posterior perforation or full-thickness perforation. When comparing both groups (perforated vs non-perforated), perforation status did not seem to affect improvement in corrected distance visual acuity (P = .65) and mean spherical equivalence (P = .19).

Such a high incidence of microperforation in planned intrastromal incisions could be explained by a deficiency in adequate imaging or by the inability of the femtosecond laser to deliver its energy in the intended location. It is possible that the incidence of perforation would be reduced by leaving a larger percentage of uncut cornea anteriorly. A deeper incision would lead to a loss of refractive effect and require longer arc length incisions with further corneal nerve ablation. It is not clear whether our results extend to different laser platforms or whether the incidence noted in our series is machine specific.

The loss of integrity of an intrastromal incision may lead to undesired consequences, although no infections or increased pain or foreign body sensation were noted in our series. Intrastromal arcuate keratotomies may be less effective at correcting astigmatism if gas escapes during incision creation. The latter may lead to a reduction in tissue dissection and subsequent loss of refractive effect. Our results show that refractive cylinder as determined by manifest refraction did not change significantly from preoperative measurements. This applied equally to non-perforated and perforated incisions. It is premature
to draw conclusions from such a finding due to our small sample size.

The current finding should prompt further research into the etiology of the unplanned anterior microperforation of intrastromal femtosecond arcuate keratotomies.

REFERENCES

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Complications From Corneal Cross-linking for Keratoconus in Pediatric Patients

To the Editor:

Corneal cross-linking (CXL) is the only treatment that potentially can block the progression of keratoconus, and studies showed low rates of failure or complication in patients older than 18 years.1 Nevertheless, there are only a few publications reporting about the outcomes and safety of CXL in patients younger than 18 years.2-4 We evaluated the complication rate of CXL for keratectasia in pediatric (younger than 18 years) and adult (18 years or older) patients for all eyes that underwent CXL from June 2008 through April 2014 in our clinical department.

CXL was performed under sterile conditions as an outpatient procedure using the standard Dresden protocol (ultraviolet-A light wavelength: 370 nm, irradiance: 3 mW/cm²).5 Postoperatively, a combination of betamethasone and neomycin eye drops was given four times daily with weekly tapering for 1 month, and a soft bandage contact lens was kept in place until full corneal reepithelialization occurred. Patients were advised to use preservative-free artificial tears for the first 6 postoperative months.

We assessed 133 eyes, including 103 eyes of adult patients and 30 eyes of pediatric patients. There were no significant differences between the patient groups regarding maximum keratometry value, thinnest corneal thickness, corrected distance visual acuity (CDVA), and follow-up time. A complication was defined as a loss of two or more Snellen lines of CDVA at the end of the follow-up compared to preoperatively. We observed complications in 2 eyes during the mean follow-up time of 13.5 ± 13.1 months, yielding a complication rate of 1.5% for all patients. Because both complications occurred in the pediatric patient group, the complication rate in this group was higher, with borderline statistical significance (P = .049). One 15-year-old patient presented with a severe bacterial keratitis 3 days postoperatively, and another 16-year-old patient showed an infectious crystalline keratopathy 3 weeks after the procedure (Figure 1).

Our findings differ from previously recorded data,2-4 which may be related to different patient characteristics. Vinciguerra et al.4 reported no major complications after CXL in pediatric patients but, in contrast to our study, patients with poor compliance were excluded. The findings of Chatzis et al.,3 who found a similar safety profile for CXL in pediatric and adult patients, are also not directly comparable to our results due to an older mean patient age in their pediatric group (16.6 years) compared to ours (14.7 years). In the context of postoperative complications after CXL, a previous report about challenges due to lack of compliance in patients with Down syndrome is noteworthy.6

In our two cases with microbial infections, contact with the infectious agent likely occurred in the early postoperative period rather than during the surgical procedure, because CXL has a toxic effect on bacteria and fungi.7 Until complete healing of the epithelium, good compliance of the patient with regular application of antibiotic eye drops and avoidance of dust/dirt exposure is important. We want to highlight that parents and patients should be well informed about the recommended behavior after CXL. Furthermore, we
strongly recommend close postoperative monitoring of pediatric patients with daily clinical controls of the treated eye in the first days after CXL to reduce the risk of severe complications.

REFERENCES

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Intraoperative Wavefront Aberrometry for Toric Intraocular Lens Placement in Eyes With a History of Refractive Surgery

To the Editor:

Eyes with a history of refractive surgery render intraocular lens (IOL) power selection particularly difficult, but intraoperative wavefront aberrometry has shown promising results. Although it is uncommon for eyes to have significant residual corneal astigmatism after refractive surgery, such cases do exist and present an extra challenge.

We retrospectively assessed the accuracy of the ORA system for toric IOL power selection in eyes with a history of refractive surgery and significant residual astigmatism. More than 200 records of eyes that underwent cataract surgery with the ORA system were reviewed and 15 eyes were identified that underwent toric IOL implantation. Twelve eyes had a history of myopic LASIK and three of hyperopic LASIK. The ORA predictive accuracy was compared to the SRK-T formula using axial length measurements from the IOLMaster (Carl Zeiss Meditec, Dublin, CA) and keratometry values from the IOLMaster or corneal topography and the American Society of Cataract and Refractive Surgery (ASCRS) online calculator. Preoperative cylinder power and axis were calculated using the Alcon AcrySof or the Abbott Medical Optics toric calculators. Postoperatively, corrected distance visual acuity and manifest refraction 1 month after cataract surgery were recorded.

Axial length ranged from 22.67 to 27.72 mm and average keratometry values from 38.87 to 48.29 D. The IOL spherical power changed from the preopera-
tive plan in 11 eyes, with a 1.50-D or greater change in 3 eyes. The IOL cylindrical power changed in 5 eyes (33%). Mean preoperative keratometric astigmatism was 2.09 ± 0.67 D. The mean residual astigmatic prediction using the ORA system was 0.64 ± 0.61 D and the mean postoperative manifest astigmatism was 0.74 ± 0.63 D. Twenty-seven percent of the eyes had 0.25 D or less of astigmatism postoperatively, 47% had 0.50 D or less, 60% had 0.75 D or less, and 73% had 1.00 D or less.

The mean ORA prediction error was 0.43 ± 0.33 D, compared to a mean prediction error of 0.77 ± 0.56 D for the calculated preoperative lens choice using the IOLMaster (t test, P = .03) and 0.61 ± 0.34 D using the online ASCRS calculator (t test, P = .08). As seen in Figure 1, which summarizes the postoperative spherical equivalent for all eyes, 80% of the treated eyes ended up with a spherical equivalent of 0.75 D or less, whereas only 53% of them would have achieved this if the calculated preoperative lens per IOLMaster was implanted instead.

This study is the first to report the successful use of intraoperative aberrometry in eyes undergoing toric IOL implantation after refractive surgery. However, our results are limited by the retrospective design of the study and the small number of patients.

REFERENCES


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Figure 1. Refractive outcomes with intraoperative wavefront aberrometry (ORA), IOLMaster (Carl Zeiss Meditec, Dublin, CA), and the American Society of Cataract and Refractive Surgery calculator. D = diopters