An 81-year-old man had femtosecond laser–assisted cataract surgery in his right eye. During the final few seconds of treatment, there was an abrupt loss of suction that resulted in inadvertent corneal application. Under the operating microscope, a central waffle pattern without corneal opacification was seen over the cornea. Conventional phacoemulsification was carried out uneventfully. The corneal laser marks did not significantly obscure the surgical view. Postoperatively, the corrected distance visual acuity (CDVA) was 6/6 at 1 day and 6/9 at 1 year. The corneal stromal scars were still present, but the patient maintained good CDVA and had no visual complaints. There was a significant endothelial cell loss of 47.9% at 2 weeks and 64.6% at 1 year. This case illustrates an uncommon complication of femtosecond laser–assisted cataract surgery and its possible effect on endothelial cell loss, although good visual acuity can be achieved.

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INADVERTENT LASER APPLICATION TO THE CORNEA DURING CATARACT SURGERY

An 81-year-old Chinese man had femtosecond laser–assisted cataract surgery for a cataract of grade 4 nuclear opalescence and color (scored according to the Lens Opacities Classification System III scale) in the right eye. Preoperatively, the corrected distance visual acuity (CDVA) in the eye was 6/15 and the patient complained of the poor vision. The CDVA in the fellow eye was 6/6 after previous complicated cataract surgery with toric monofocal IOL implantation, which had been performed elsewhere. Bilateral retinal pigment epithelium atrophy was noted over the macula on dilated fundus examination. The pupillary dilation with mydriatic drops was good, and the preoperative ECC was 2231 cells/mm² in the right eye and 827 cells/mm² in the pseudophakic left eye.

The patient was transferred to the operating table, and the cornea was examined using the operating microscope. A central waffle pattern was seen over the cornea with no corneal edema or opacification. The patient was informed of the findings, and a decision was made to proceed with the planned phacoemulsification. The patient was seated upright to make corneal markings to assist toric IOL implantation. The femtosecond laser-created capsulotomy appeared complete with adequate lens treatment.

Conventional phacoemulsification was carried out using the Whitestar Signature phacoemulsification system (Abbot Medical Optics, Inc.). Corneal wounds were created, and a cohesive ophthalmic viscosurgical device (OVD) was injected. The anterior capsule flap of the completed capsulotomy was removed. Phacoemulsification was performed using the stop-and-chop technique. Sculpting was performed at a power of 45% and vacuum of 50 mm Hg. Segment removal was performed at a power of 40% and vacuum of 230 mm Hg. After the cortex was removed and the capsular bag filled with OVD, a toric monofocal IOL was placed and the procedure was completed uneventfully. The entire surgical time including phacoemulsification was 21 minutes. The cornea remained clear throughout the surgery, and the corneal laser marks did not significantly obscure the surgeon’s view. The patient was discharged with topical prednisolone acetate 1.0% and tobramycin and dexamethasone (Tobradex) 4 times a day.

One day postoperatively, the acuity CDVA was 6/6. Subjectively, the patient was happy with the visual outcome. On examination, a waffle laser pattern was seen in the deep posterior stromal to the preDescemet layer of the central cornea (Figure 1). Minimal inflammation was seen in the anterior chamber. The CDVA remained good despite the stromal scars. At 2 weeks (Figure 2), the ECC was 1162 cells/mm².

At 1 year (Figure 3), the patient was asymptomatic with “good vision.” Examination revealed corneal stromal scars with a CDVA of 6/9. Central corneal thickness was 567 μm in the right eye and 582 μm in the left eye. Endothelial cell counts were 789 cells/mm² and 798 cells/mm², respectively.

DISCUSSION

The femtosecond system provides image guidance, which has improved the precision and consistency of cataract surgery. Femtosecond-assisted surgery enables
minimal use of phacoemulsification energy and preservation of endothelial cells. With increasing surgical experience, the adjunctive use of the laser in cataract surgeries is being explored in more complex cases.

The Catalys laser system allows the creation of a lens fragmentation pattern of a central cross and multiple small cubes to soften the lens. The laser begins the lens fragmentation treatment from the posterior aspect of the lens and then moves anteriorly. Hence, in our case, when suction was broken toward the end of surgery, the misfiring of the laser created a waffle pattern that was seen on the patient’s cornea. The laser-created capsulotomy and lens fragmentation were otherwise fairly complete. The machine has an inbuilt safety mechanism with motion sensors to detect excessive head movements. It is likely that before the machine was able to detect the suction break, air entered the liquid–optic interface, changing the point of focus of the laser beam.

To our knowledge, there are 2 other case reports of laser energy delivered to the corneal stroma during femtosecond laser-assisted cataract surgery. In all 3 cases, there was an abrupt suction loss during lens fragmentation treatment. Fortunately, good visual acuity was achieved in all cases and patients were satisfied with their visual outcomes. There could have been endothelial injury if the laser had been fired at the level of the endothelium or superficial to that layer. Suction breaks during the laser procedure are a known intraoperative occurrence. However, in most cases, treatment is discontinued when the foot switch is released, with no adverse events. The fraction of a second time lag between suction break and release of the foot switch was probably what led to the laser being applied to the cornea in these cases.

Conrad-Hengerer et al. compared femtosecond laser-assisted cataract surgery and conventional cataract surgery and found a mean endothelial cell loss of 7.9% at 1 week postoperatively and 8.1% at 3 months in the femtosecond laser-assisted cataract surgery group compared with 12.1% and 13.7%, respectively, in the conventional cataract surgery group. Our case shows a dramatic postoperative endothelial cell loss of 47.9% at 2 weeks after femtosecond laser-assisted cataract surgery and 64.6% at 1 year. As the phacoemulsification was otherwise uneventful and the laser burns were fairly deep in the cornea, the inadvertent laser delivery may have contributed to the endothelial cell loss.

We conclude that surgeons should be aware of the intrinsic vulnerability of technology and its application in the trend toward the use of new technologies. We also propose more safeguard mechanisms, both human and technological, that will stop laser application when there is significant patient or eye movement, with or without loss of suction. With further advances and modifications to the laser system, the safety mechanism could be improved, enabling earlier detection of a suction break and automatic abortion of the laser. Although good visual acuity was achieved at the end of the surgery in the 3 reported cases, significant endothelial cell loss might have occurred as a consequence of the laser application, as seen in our case. Cataract surgeons should be aware of this uncommon complication of femtosecond laser-assisted cataract surgery and its potential consequences.

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