

Corneal ectasia after photorefractive keratectomy

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Two patients developed corneal ectasia after photorefractive keratectomy (PRK). Case 1 had evidence of early keratoconus preoperatively, with manifest refractions of $-4.00 +2.50 \times 160$ (20/20) in the right eye and $-7.00 +3.00 \times 180$ (20/30) in the left eye; thin corneas (472 μm and 441 μm , respectively); and inferior paracentral steepening in the right eye and central steepening in the left eye on topography. Case 2 had manifest refractions of $-8.50 +3.75 \times 123$ (20/20⁻²) in the right eye and $-9.25 +4.00 \times 077$ (20/20⁻¹) in the left eye; corneal thickness of 509 μm and 508 μm , respectively; and symmetric bow-tie patterns in both eyes on topography. Case 2 had a family history suspicious for keratoconus, with a sibling who had bilateral corneal transplantation at a young age. Both patients developed bilateral corneal ectasia after PRK.

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Corneal ectasia is a rare but well-described complication of laser in situ keratomileusis (LASIK).^{1–5} Reported risk factors include high myopia, low residual stromal bed thickness, and keratoconus or forme fruste keratoconus, although cases without preoperative risk factors have been reported.^{6,7} Ectasia has rarely been reported after photorefractive keratectomy (PRK).^{2,8,9} We report 2 cases of ectasia after PRK and discuss possible risk factors for this complication.

CASE REPORTS

Case 1

A 37-year-old African-American man presented for refractive surgery evaluation at an outside facility in Georgia in May 2005. The best spectacle-corrected visual acuity (BSCVA) was 20/20 with a manifest refraction of $-4.00 +2.50 \times 160$ in the right

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eye and 20/30 with a manifest refraction of $-7.00 +3.00 \times 180$ in the left eye. Keratometry readings were 45.5/46.5 \times 105 and 48.5/50.2 \times 104, respectively. The thinnest central corneal thickness readings measured by ultrasound pachymetry were 472 μm in the right eye and 441 μm in the left eye. Topography showed inferior paracentral steepening in the right eye and central steepening in the left eye (Figure 1). The remainder of the examination was reportedly normal. The patient had no pertinent ocular history, including past trauma, amblyopia, or strabismus, and no family history of keratoconus. Because of the reduced corneal thickness, the patient's physician decided to perform PRK instead of LASIK.

The patient had reportedly uneventful PRK in both eyes in August 2005 with the Visx S4 excimer laser. Epithelial removal was performed with the Visx phototherapeutic keratectomy (PTK) setting, and then laser ablation was performed with the CustomVue wavefront-guided platform. The planned ablation depths were 53 μm in the right eye and 100 μm in the left eye.

At 1 day, the uncorrected visual acuity (UCVA) was 20/100 in both eyes but at 1 week, it was counting fingers in the right eye and 20/200 in the left eye. Prednisolone acetate 1% was increased to every 2 hours in both eyes for suspected haze. By the second week, the UCVA had not improved and intraocular pressure (IOP) rose to 32 mm Hg in the right eye and 28 mm Hg in the left eye. The treating physician suspected early ectasia and prescribed dorzolamide hydrochloride–timolol maleate (Cosopt) twice a day and travoprost (Travatan) at bedtime in both eyes. Two days later, the IOP improved to 10 mm Hg in the right eye and 6 mm Hg in the left eye but the BSCVA remained 20/200 in both eyes. At this time, the treating physician diagnosed ectasia after PRK and the patient sought a second opinion regarding diagnosis and management.

On presentation 3 weeks after PRK, the UCVA was 20/150 in both eyes and the BSCVA was 20/100 in the right eye and 20/50 in the left eye with manifest refractions of $+1.25 +0.50 \times 150$ and

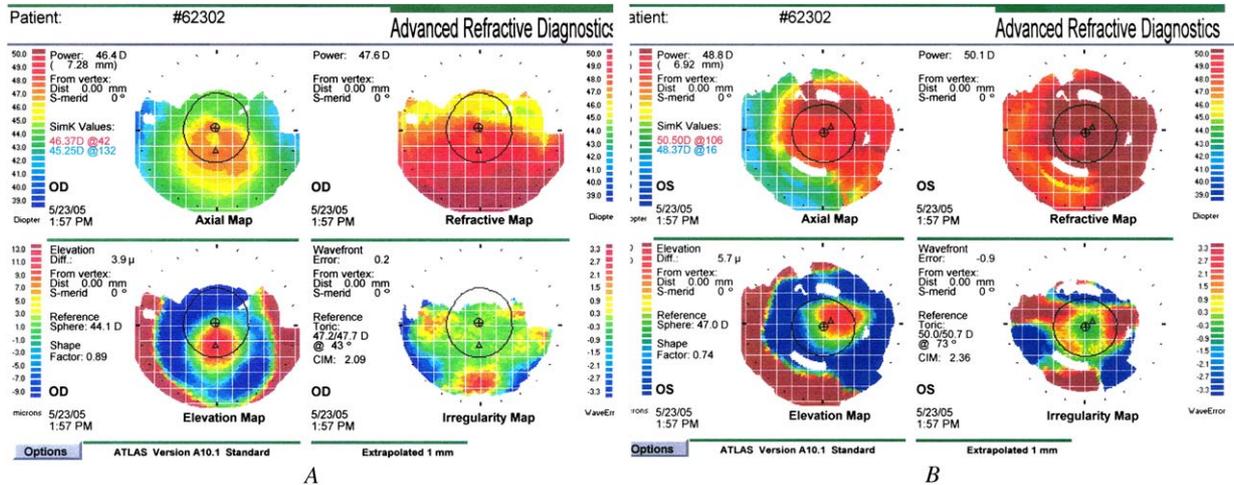


Figure 1. A: Case 1, right eye. Preoperative topography showing inferior steepening, with a central K-reading of 46.4 D. B: Case 1, left eye. Preoperative topography showing central steepening, with a central K-reading of 48.8 D.

-4.75 + 2.00 × 105, respectively. Central corneal thickness measurements obtained by ultrasound pachymetry were 349 μm and 384 μm, respectively. Topography showed central steepening in both eyes (Figure 2), and slitlamp examination demonstrated significant corneal thinning, worse in the right eye than in the left (Figure 3). The patient was referred for rigid gas-permeable contact lens fitting.

Case 2

A 40-year-old Hispanic man presented for refractive surgery evaluation in December 2004. The manifest refraction was -8.50 + 3.75 × 123 (20/20⁻²) in the right eye and -9.25 + 4.00 × 77 (20/20⁻¹) in the left eye. Pachymetry was 509 μm and 508 μm, respectively. Preoperative topography exhibited a symmetric

bow-tie pattern bilaterally, with Sim-K values of 46.68/43.21 in the right eye and 46.80/43.38 in the left eye (Figure 4).

The patient's medical history was remarkable for premature birth at 28 weeks gestation, with a birth weight of 1450 grams. Family history was significant for 1 of 4 sisters who had bilateral corneal transplantation as a teenager. This sibling died 5 years earlier, and further details of her medical history, including the reason for corneal transplantation, were unknown.

Retinoscopy, slitlamp examination, and IOP were normal in both eyes. Fundoscopic examination of the right eye revealed a mildly dragged disc, mild temporal displacement of the macula, an old ridge from retinopathy of prematurity, and areas of lattice degeneration. The fundus in the left eye was normal.

The patient had uneventful bilateral PRK in December 2004 performed by 1 of us (A.I.C.). The epithelium was removed with the Amoils brush (Innovation Excimer Solutions, Inc.). Excimer

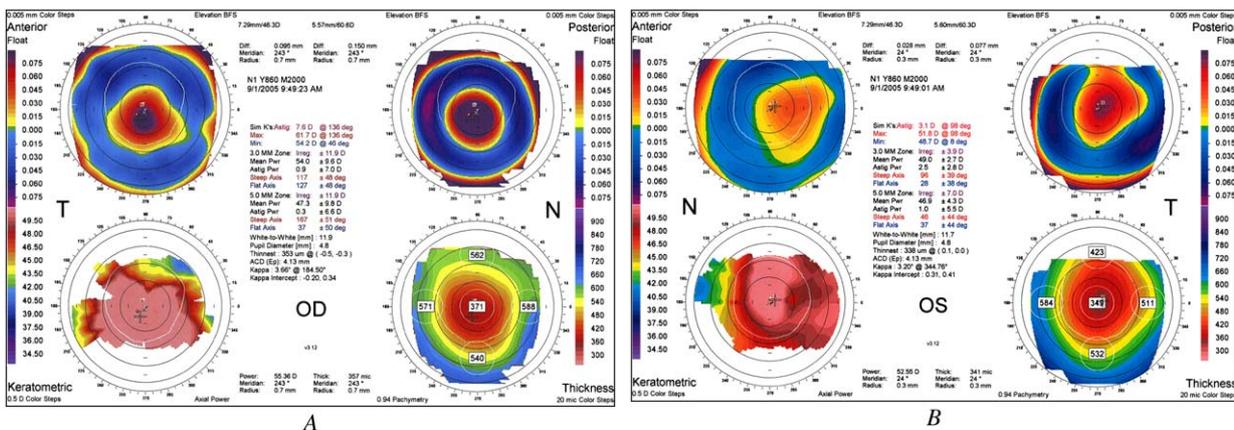


Figure 2. A: Case 1, right eye. Postoperative topography showing significant central steepening, central corneal thinning, and increased posterior float, with a central K-reading of 55.3 D. B: Case 1, left eye. Postoperative topography showing significant central steepening, central corneal thinning, and increased posterior float, with a central K-reading of 52.5 D.

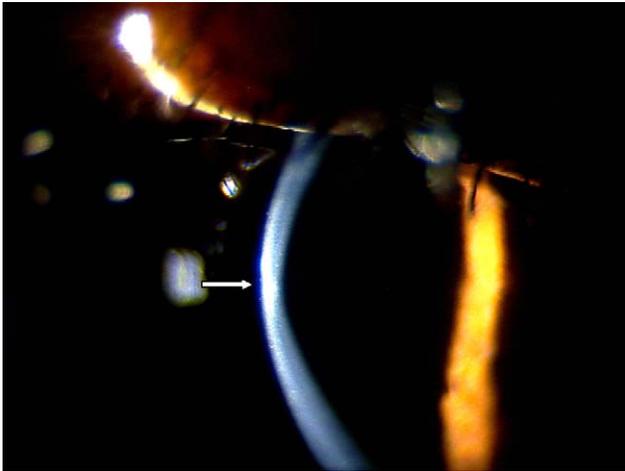


Figure 3. Case 1, right eye. Slitlamp view demonstrates significant corneal thinning (arrow).

laser ablation was performed with the Alcon LADARVision excimer laser, using nonwavefront software and an optical zone of 6.3 mm with a blend zone to 8.3 mm. Mitomycin-C 0.02% was applied to each cornea for 30 seconds using a circular sponge after laser ablation. Planned central ablation depth was 98 μm in the right eye and 106 μm in the left eye. Following excimer ablation and 10 seconds of cooling irrigation of the eye, the residual stromal thickness was measured by ultrasound as 365 μm in the right eye and 356 μm in the left eye.

Three weeks postoperatively, the UCVA was 20/25 in both eyes. At 6 weeks, the UCVA was 20/25 in the right eye and 20/30 in the left eye. The BSCVA was 20/20⁻¹ with a manifest refraction of +0.50 +0.75 \times 111 in the right eye and 20/20⁻² with a manifest refraction of -1.00 +2.00 \times 60 in the left eye. The IOP was 27 mm Hg in both eyes on topical steroid drops 3 times daily.

After reducing the steroid drops to once a day, the IOP was 13 in both eyes.

At 10 months, the UCVA was 20/25 in the right eye and 20/30 in the left eye and the BSCVA was 20/20 in both eyes with manifest refractions of -0.25 +1.00 \times 117 in the right eye and -1.50 +2.25 \times 150 in the left eye. Topography revealed inferonasal steepening suggestive of early corneal ectasia (Figure 5). At this visit, the patient was asked about eye rubbing. He noted, and his wife confirmed, that he frequently rubbed his eyes, at least several times a day. He was cautioned to stop rubbing his eyes to avoid exacerbating ectasia.

DISCUSSION

Corneal ectasia is a rare complication of LASIK characterized by progressive corneal thinning associated with loss of UCVA and often BSCVA.⁴ Identifiable preoperative risk factors have been defined,⁴ but cases without risk factors have also been reported.^{6,7} These cases show that ectasia can also occur after PRK in eyes with known risk factors such as inferior topographical steepening (as in Case 1) and in eyes without definite risk factors.

Previous reports of ectasia after PRK are limited. Holland et al.² report 3 patients who developed ectasia after PRK; all cases had multiple retreatments, 1 resulting in corneal perforation, or were diagnosed as keratoconus suspects preoperatively, although no topographies were published. Lovisolo and Fleming⁸ also report 2 cases of ectasia after PRK. One case occurred in a highly myopic eye (-13 D) after retreatment with PTK for haze; the other case had a preoperative diagnosis of keratoconus. Parmar and Claoue⁹ report a case of unilateral ectasia after bilateral PRK for high myopia (-9.75 D). No preoperative

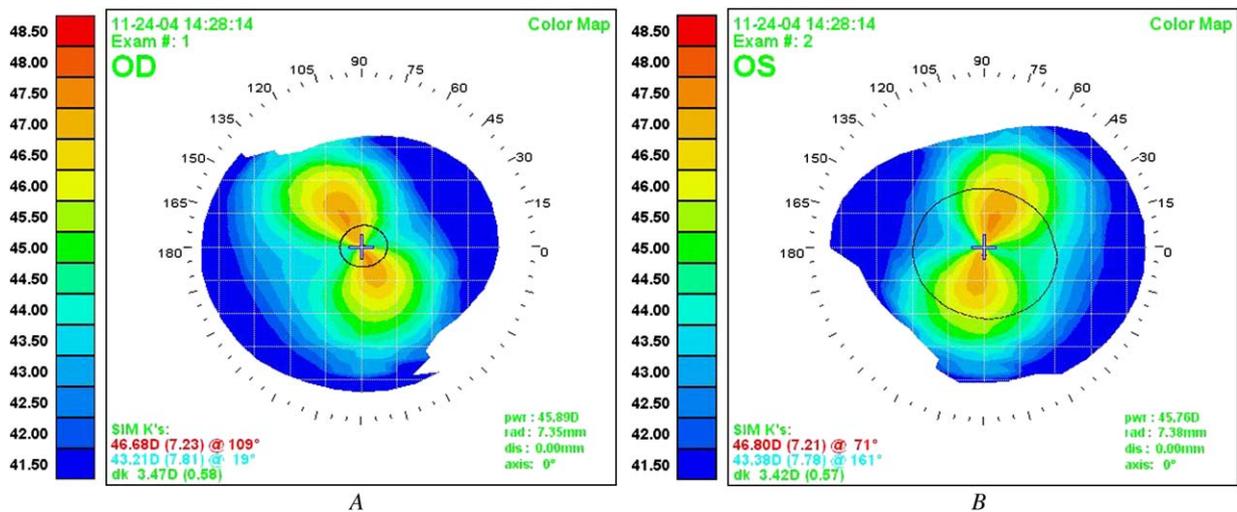


Figure 4. A: Case 2, right eye. Preoperative topography shows symmetric bow-tie pattern, with a central K-reading of 45.8 D. B: Case 2, left eye. Preoperative topography shows symmetric bow-tie pattern, with a central K-reading of 45.7 D.

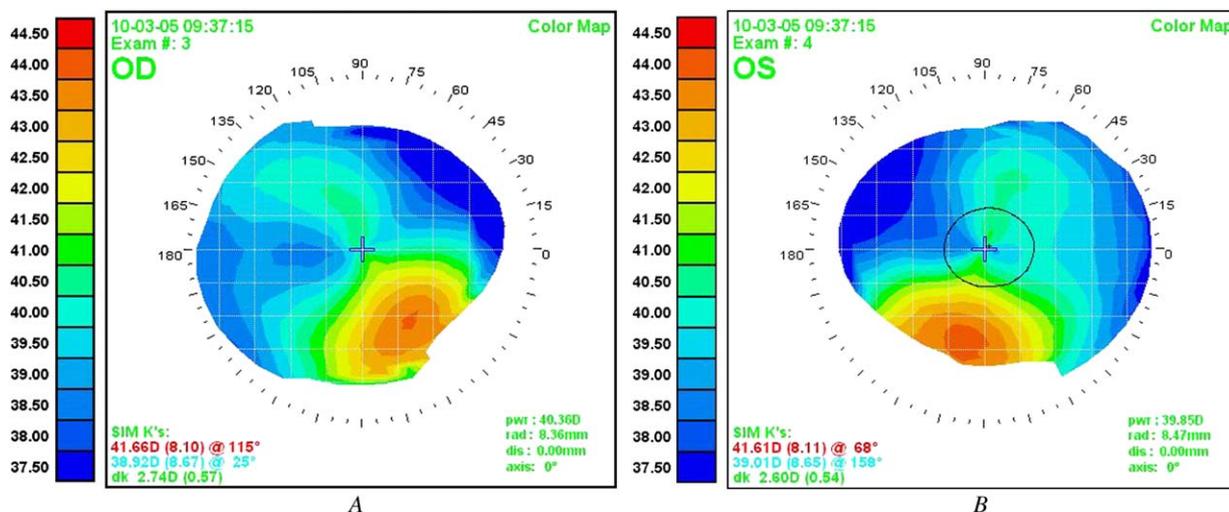


Figure 5. A: Case 2, right eye. Postoperative topography shows significant inferior steepening. B: Case 2, left eye. Postoperative topography shows significant inferior steepening.

topographies or pachymetry values were available for review in this case.

One of our cases had preoperative findings suggestive of early keratoconus including high astigmatism, steep central corneas, thin corneas, and BSCVA less than 20/20. The second case had a symmetric bow-tie topographic pattern bilaterally, although the patient had high astigmatism and a family history of bilateral keratoplasty in a sibling at a young age. Keratoconus may have been the reason for the sibling having corneal transplantation so early. The transient increased IOP and the history of eye rubbing may also have contributed to the development of ectasia in this case as eye rubbing has been associated with worsening of keratoconus in susceptible individuals.^{10,11}

These cases are extremely relevant currently as there is ongoing debate about the safety and efficacy of surface ablation for keratoconus suspects, with some authors advocating surface ablation techniques for these patients (S.P. Amoils, MD, "PRK in Latent Keratoconus and High Myopia After RK," presented at the ASCRS Symposium on Cataract, IOL and Refractive Surgery, San Diego, California, USA, May 2004). As demonstrated by these cases and those previously reported,^{2,8,9} ectasia can occur after surface ablation in patients with keratoconus or in keratoconus suspects. In patients with preexisting keratoconus, ectasia may develop even more rapidly.

In conclusion, corneal ectasia can occur after PRK, especially in susceptible individuals. Extreme caution and extensive patient counseling should be used with patients

with known risk factors for postoperative ectasia, including early keratoconus or positive family history of keratoconus, even if surface ablation techniques are used instead of LASIK.

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