

# Late-Onset Laser In Situ Keratomileusis–Related Corneal Ulcer—A Case Series

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## CASE REPORTS

**Purpose:** To report 4 cases of flap margin–related corneal ulcer that developed 5 years after laser in situ keratomileusis (LASIK) procedures.

**Methods:** We retrospectively documented the clinical and laboratory characteristics of all patients between 2004 and 2008 who presented with LASIK-related corneal ulcer that appeared >5 years postoperatively. The 4 patients who had this condition were 25-, 33-, 61-, and 62-year-old males.

**Results:** Two patients had cultures positive to *Staphylococcus aureus* and *Streptococcus epidermidis*. Two ulcers healed after standard fortified topical antibiotic regimen, 1 ulcer healed after treatment with moxifloxacin, and the fourth healed after treatment with lomefloxacin. All cases presented 5 years after the LASIK procedure.

**Conclusions:** LASIK procedures can be associated with the risk of corneal infection even years later. The mechanism may be flap margin instability causing epithelial defense barrier disturbance.

**Key Words:** LASIK, corneal ulcer, late complications

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Laser in situ keratomileusis (LASIK) is presently the most common refractive procedure. The incidence of infectious keratitis after LASIK is estimated as being between 1/2919 and 1/5000.<sup>1,2</sup> There are few reports of late-onset flap margin–related corneal ulcers in the literature: Most ulcers appeared between 3 and 15 months postoperatively.<sup>3,4</sup> Recently, a case series reported 2 patients with keratitis occurring 2 and 6 years after the operation.<sup>5</sup> We report 4 cases of flap margin–related corneal ulcers that did not develop until 5 years after the LASIK procedure.

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### Case 1

A 33-year-old man underwent uneventful myopic LASIK in both eyes in April 1999. According to his medical record, uncorrected visual acuity was 20/20 in each eye after the procedure. He presented to our emergency services in May 2004 with acute onset of redness and pain in his left eye. He denied rubbing the eye and any recent trauma. Ocular examination revealed an infiltrate along the wound margin underlying a 1.0 × 0.4-mm epithelial erosion. The best spectacle–corrected visual acuity in that eye was 20/30. The fellow eye appeared normal on examination, with an uncorrected visual acuity of 20/20. There were no predisposing risk factors for a corneal ulcer other than the LASIK procedure itself.

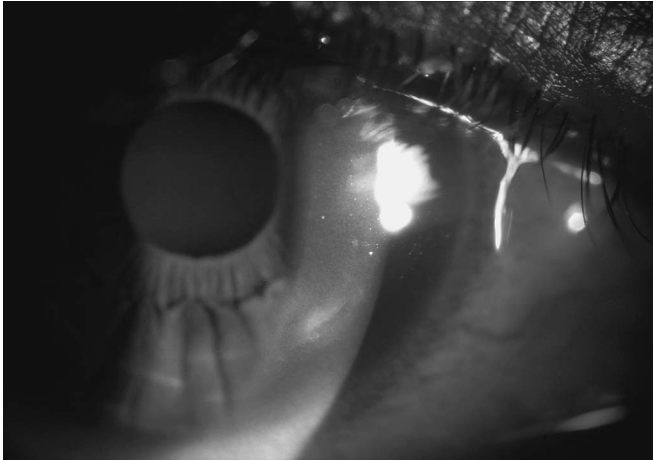
The patient was admitted to our department where corneal scrapings were taken for stains and cultures (bacteria, fungi, and acid-fast bacilli). Treatment consisted of topical cefazolin 50 mg/mL and gentamicin 14 mg/mL every hour around the clock. The cultures emerged as being positive to *Staphylococcus aureus* sensitive to that empirical treatment. No steroids were used. The ulcer gradually healed over the next few days. Ten days after admission, the infiltrate was noted to be healing, there was no fluorescein staining, and the best-corrected visual acuity was 20/40. On follow-up examination 4 months later, the best-corrected visual acuity was 20/30 and slit-lamp examination revealed an old inferior stromal opacity and thinning at the flap margins.

### Case 2

A 62-year-old man presented to our outpatient cornea clinic in January 2006, 5 years after having undergone a bilateral LASIK procedure. He complained of left eye visual disturbance, accompanied by lacrimation, photophobia, and ocular pain for 4 days' duration. He had undergone treatment for trichiasis by mechanical removal of his eyelashes 1 day before admission. On examination, his best spectacle–corrected visual acuity in the left eye was 20/50, and a round corneal infiltrate was noted adjacent to the inferior flap margins with an overlying area of fluorescein staining. Blepharitis was present bilaterally. He was admitted to our ward where cultures of corneal scrapings were carried out and intensive hourly treatment with topical broad-spectrum antibiotics with cefazolin 50 mg/mL and gentamicin 14 mg/mL was initiated. Within 48 hours, the cultures yielded growth of *Staphylococcus epidermidis*, and treatment was changed according to bacterial sensitivity. A slit-lamp examination at the follow-up visit 5 weeks later revealed complete resolution of the infiltrate with best-corrected visual acuity of 20/30. The blepharitis was also treated during follow-up.

### Case 3

A 25-year-old man presented to our emergency services in September 2007, 5 years after undergoing bilateral LASIK procedure. He denied rubbing the eye and any recent trauma. On examination,



**FIGURE 1.** Slit-lamp biomicroscopy, right eye. Note the infiltrate adjacent to the borders of the LASIK flap.

the right eye's best-corrected visual acuity was 20/32+, and there was a marginal corneal erosion with an underlying infiltrate (Fig. 1). Intensive treatment with topical moxifloxacin 5 mg/mL was initiated. Follow-up examination 2 weeks later revealed very mild scarring beneath the affected area with no change in the best-corrected visual acuity.

#### Case 4

A 61-year-old man presented to our emergency services in March 2008, 5 years after undergoing LASIK surgery. He had suffered from irritation in his right eye for 3 days and denied rubbing the eye and any recent trauma. The ophthalmic examination revealed best-corrected visual acuity of 20/20 in the affected eye, and an ulcer was observed at the margin of the corneal flap, with concomitant blepharitis as a possible predisposing factor for a corneal ulcer. The patient was treated with topical lomefloxacin 3 mg/mL, which led to healing of the epithelial defect within 1 day. The underlying infiltrate gradually healed with a residual scarring. Table 1 summarizes the 4 cases described above.

### DISCUSSION

LASIK has become the most commonly performed refractive procedure over the past decade. Among its merits are rapid visual rehabilitation, decreased stromal scarring, reduced incidence of irregular astigmatism, minimal regression, minimal postoperative pain, and the ability to treat a wide range of refractive errors.<sup>6-10</sup> Because the procedure became more common, cases of post-LASIK microbial keratitis began

to appear in the literature and several predisposing factors were identified, including a history of corneal surgery,<sup>11</sup> breaks in the epithelial barrier,<sup>12</sup> excessive surgical manipulation,<sup>13</sup> intraoperative contamination,<sup>13</sup> delayed postoperative corneal reepithelialization,<sup>14</sup> and use of topical steroids.<sup>14,15</sup>

Serious consequences of an infection after LASIK are common, and they include reduction of visual acuity.<sup>16</sup> Overall, moderate to severe reduction in visual acuity occurs in nearly one half of those cases, and keratoplasty is performed in almost one sixth of the affected eyes for either therapeutic or optical purposes.<sup>16</sup> Infections after LASIK tend to occur early after the procedure. Chang et al<sup>16</sup> reviewed corneal infections in 83 eyes after LASIK and reported that 49.4% of them had developed within 7 days, with the rest occurring no more than 90 days postoperatively. The results of an American Society of Cataract and Refractive Surgery survey<sup>1</sup> demonstrated an even earlier onset of corneal infections after LASIK: Of 116 of ~338,500 procedures performed by 56 surgeons, 66% of corneal infections occurred during the first week, 6% during the second week, 15% between the second and the fourth week, and 13% between 1 and 3 months. The microbiological profile of the infection was found to be related to the time of onset of the infection<sup>16</sup>: Of the infections occurring within 7 days after LASIK, gram-positive organisms were cultured in 82.2%, *Mycobacterium* in 10.7%, fungi in 3.5%, and *Pseudomonas* in 3.5%. Infections occurring more than 7 days after LASIK had an increased prevalence of *Mycobacterium* (56.8%) as a pathogen, followed by fungi (18.2%), yeast (11.4%), polymicrobial (6.8%), gram-positive organisms (4.5%), and *Acanthamoeba* (2.2%). In a single case of infectious keratitis that occurred 15 months after LASIK, the identified organism was *Colletotrichum* (like *Fusarium*).<sup>3</sup> Another report described positive corneal scraping cultures to *Fusarium solani* and *Pseudomonas* in keratitis occurring 2 and 6 years after LASIK, respectively.<sup>5</sup>

In LASIK, unlike in other corneal incisional procedures, corneal infiltrates are not often accompanied by an epithelial defect. Creating the lamellar flap may introduce organisms into the stromal interface that cause infection after the corneal epithelium regains its continuity. We reason that perioperative inoculation is the probable etiology for infections in the early and intermediate postoperative period, but it cannot explain the pathogenesis in our patients in whom the infection occurred years later. The corneal epithelium is almost always intact by 1 day after a LASIK procedure. The stroma, however, never regains its former structure. We speculate that micro movements at the wound margin may have caused repeated

**TABLE 1.** Summary of the 4 Cases of Late-Onset LASIK-Related Corneal Ulcers

Case No.	Age (yrs)/Gender	Onset of Corneal Ulcer After LASIK Operation, yrs (Year of Presentation)	Cultured Microorganism	Initial Topical Treatment
1	33/M	5 (2004)	<i>Staphylococcus aureus</i>	Fortified ceftazolin and gentamicin
2	66/M	5 (2006)	<i>Staphylococcus epidermidis</i>	Fortified ceftazolin and gentamicin
3	25/M	5 (2007)	NA	Moxifloxacin
4	61/M	5 (2008)	NA	Lomefloxacin

M, male; NA, not applicable.

infrequent epithelial damage, thus making the flap margin an entry point for microorganisms. We base our hypothesis on the location of the ulcer at the wound edge in all of our 4 reported cases, the lack of other predisposing factors for corneal ulcer in 2 of the patients, and the long interval since surgery.

Preventive measures for early perioperative inoculation of microorganism include maintaining sterile surgical conditions, applying postoperative antibiotics, avoiding eye touching or rubbing, and avoiding instillation of fluids into the eye. To prevent late-onset LASIK-related corneal ulcers, we suggest avoiding eye rubbing, avoiding use of contact lenses, and controlling blepharitis.

To conclude, LASIK might have long-term effects on the cornea, making it vulnerable to flap margin-related corneal ulcers, probably through a mechanism of flap margin instability. It may be prudent to maintain long-term follow-up in patients undergoing the procedure and underline the desired preventive measures.

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