case reports

Topography changes associated with sublamellar epithelial ingrowth after laser in situ keratomileusis

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ABSTRACT

Laser in situ keratomileusis (LASIK) was performed in 1 eye of a patient for correction of myopia. The patient was evaluated postoperatively using both Placido-disk-based videokeratography and raster stereography. The patient developed an epithelial defect and subsequent sublamellar epithelial ingrowth after LASIK. The Placido-disk system demonstrated an area of flattening over the area of epithelial ingrowth and raster stereography more specifically identified the area over the epithelial ingrowth as an area of relative elevation. *J Cataract Refract Surg 2000; 26:1413–1416 © 2000 ASCRS and ESCRS*

Epithelial ingrowth may lead to elevation of the corneal flap after laser in situ keratomileusis (LASIK) and may be detected by corneal topography analysis. We report such an occurrence in 1 eye that had LASIK for myopia.

Case Report

A 50-year-old man was seen for LASIK surgery. Refraction was −9.75 −0.50 × 85 in the right eye and −8.50 −0.50 × 148 in the left eye, correcting visual acuity to 20/20 in both eyes. Keratometry was 44.75/44.37 × 25 in the right eye and 44.62/44.37 × 155 in the left eye. Videokeratography using a Placido-disk-based videokeratography instrument (EyeSys Technologies, Inc.) showed normal topography. After the risks and benefits of all refractive procedures were explained, the patient consented to have LASIK, initially in the right eye using the Summit Technology Apex Plus excimer laser and the Automated Corneal Shaper (Bausch & Lomb Surgical). Attempted correction was −9.80 diopters. Surgery was uneventful.

One day postoperatively, uncorrected visual acuity (UCVA) was 20/200. Slitlamp microscopy showed moderate conjunctival injection. The LASIK flap was in place. No flap striae, sublamellar inflammation, sublamellar debris, or sublamellar epithelium were seen. There was, however, a fibrin-like deposition on the epithelium and a 4.0 × 6.0 mm frank epithelial defect in the temporal area. The patient was treated with ciprofloxacin and prednisolone acetate 4 times daily.

Four days after LASIK, UCVA remained unchanged. Slitlamp microscopy revealed the epithelial defect had decreased in size to 2.0 × 1.0 mm. Medications were continued 4 times daily.

Twelve days postoperatively, the patient reported eye redness and double vision. His UCVA was 20/60. Slitlamp microscopy revealed an unusual fibrin reaction with a membrane firmly adherent to his nasal conjunctiva. This membrane was difficult to strip and acted like a true membrane, with bleeding upon stripping. Cultures were sent and grew

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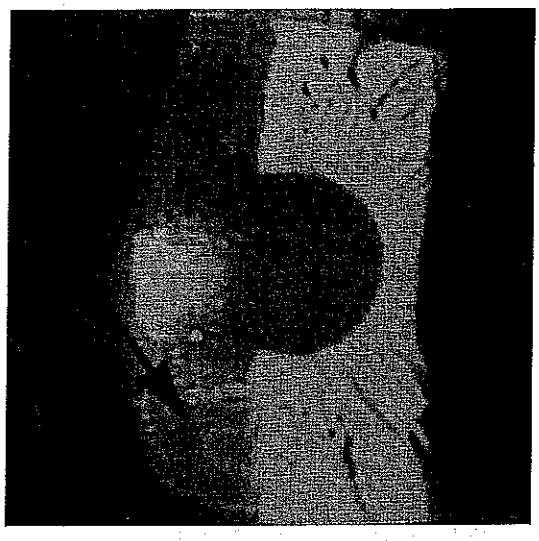

Figure 1. (Lumba) Ten weeks postoperatively, epithelial ingrowth can be seen inferotemporally.

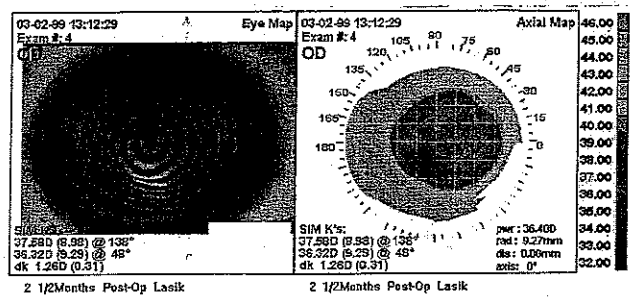

Figure 2. (Lumba) *Left*: Instantaneous radius of curvature topography map shows flattening over the central edge of the epithelial ingrowth. *Right*: A Placido-disk image also shows flattening over epithelial ingrowth with steepening at the flap edge.

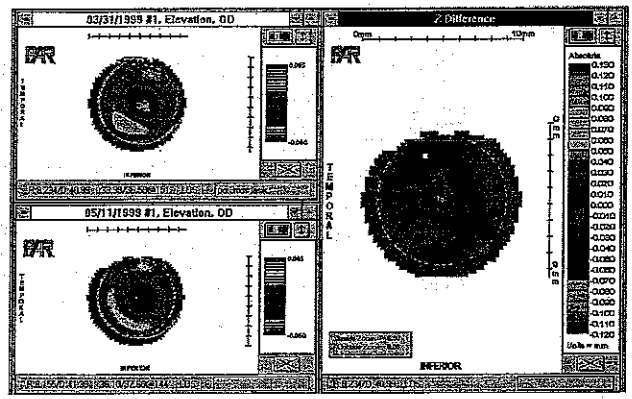

Figure 3. (Lumba) *Upper left*: At 3 months, the PAR CTS shows an elevated area corresponding to epithelial ingrowth. *Bottom left*: The PAR CTS taken after epithelial removal shows more regular contour of the corneal surface. *Right*: The elevation difference shows decreased elevation after epithelial removal.

Streptococcus oralis. The patient was placed on penicillin drops every hour with slow resolution of the reaction.

At 1 month, manifest refraction was +2.75 −3.25 × 70, giving 20/60 visual acuity. Uncorrected visual acuity was 20/100^{-2}. Slitlamp examination revealed a residual membrane over the nasal conjunctiva. The patient was continued on prednisolone acetate 1%, ofloxacin, and penicillin drops 4 times a day.

Ten weeks after LASIK, UCVA was 20/30^{-2} with a manifest refraction of +1.75 −1.50 × 60, giving a visual acuity of 20/20. An area of sublamellar epithelial ingrowth was noted temporally (Figure 1). Corneal topography showed an area of flattening over this area with a zone of peripheral steepening at the flap edge (Figure 2).

Three months postoperatively, UCVA was 20/40 with a manifest refraction of +0.75 −3.00 × 57, giving visual acuity of 20/25. The Placido-disk topography system revealed persistence of the flat area over the area of epithelial ingrowth. Rasterstereography using the PAR Corneal Topography System (CTS) (PAR Microsystems, Inc.) was then used to identify the flattened area as an area of relative elevation, with the highest point being 0.050 mm high and located inferotemporally (Figure 3, *upper left*).

At 4 months, UCVA was 20/50^{+2} with a manifest refraction of +1.75 −2.75 × 60, giving visual acuity of 20/25. On slitlamp microscopy, the area of epithelial ingrowth appeared to be the same size as at 1 month postoperatively.

One week later, the epithelial ingrowth was removed. Initially, the flap was marked at slitlamp examination. The Hersh LASIK retreatment spatula (ASICO, Inc.) was used to delineate the border of the flap. With a Hersh LASIK retreatment forceps (ASICO, Inc.) the flap was lifted. Sheets of epithelial cells were apparent on the stromal bed and were easily removed with blunt dissection using dry cellulose sponges (Figure 4). After the area was free of residual epithelial cells, the flap was repositioned and a bandage contact lens placed.

An examination the next day showed the flap was in position with no residual epithelial ingrowth (Figure 5). One week after the removal of the epithelial ingrowth, the PAR CTS showed that the area of elevation was less elevated and had a more regular contour (Figure 3, *lower left*). The highest point in this area was 0.030 mm. The elevation difference map (Figure 3, *right*) similarly showed the change in the elevated area after removal of the epithelial ingrowth. Slitlamp examination revealed the flap to be in place, without flap striae, sublamellar inflammation, or sublamellar epithelium. Uncorrected visual acuity was 20/40.

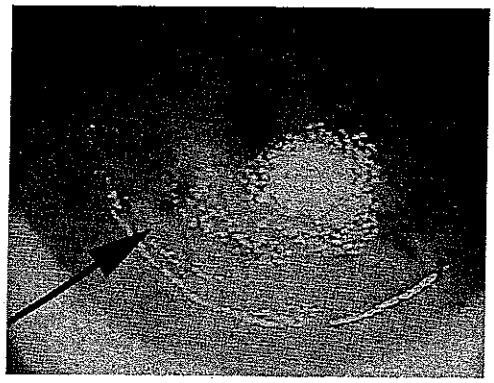

Figure 4. (Lumba) An intraoperative photograph shows the inner edge of the epithelial ingrowth as indicated by the arrow

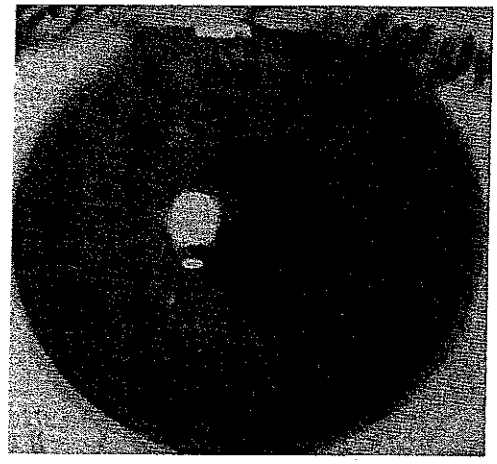

Figure 5. (Lumba) A postoperative slitlamp picture shows no residual epithelial ingrowth.

Discussion

Epithelial ingrowth is one of the more serious complications of LASIK, with an incidence ranging from 4% to 9%.[1] Epithelial cells grow along the interface (i.e., the potential space between the repositioned lenticule and the remaining stroma).[2]

Two systems of videokeratography, a Placido-disk-based system and rasterstereography, were used in evaluating our patient. Both systems showed distortion of the corneal surface secondary to epithelial ingrowth. The Placido-disk system identifies any areas of steepening or flattening but may not be able to differentiate areas of elevation or depression. Rasterstereography using the PAR CTS unit more specifically identifies the degree of relative surface elevation.[3,4]

We have shown that areas of scarring after PRK may cause localized steepening of corneal topography.[5] In this report, we similarly demonstrate that sublamellar epithelium ingrowth after LASIK can be detected using videokeratography, resulting from surface elevation of the flap. Indeed, irregular topography after LASIK may signal sublamellar epithelial ingrowth in some cases.

In the case reported, videokeratography indicated an area of flattening in the location of sublamellar epithelium noted by slitlamp examination. Moreover, rasterstereography demonstrated this area of flattening to be elevated. It is likely, therefore, that the epithelial ingrowth both raised and flattened the flap, giving the topography seen. We have suggested that the lamellar flap created in LASIK may "mask" and smooth underlying topography abnormalities, mitigating their manifestation.[6,7] In contrast, as seen in this case, a mass effect underlying the flap may cause its elevation and distortion.

In our patient, the area of epithelial ingrowth was located temporally, where the microkeratome blade began its path to create the flap. Helena and coauthors[8] suggest a theoretical mechanism for epithelial ingrowth that involves dragging cells with the microkeratome blade. They suggest that transfer of microscopic nests of transient amplifying cells into the interface by the microkeratome blade is a common mechanism for epithelial ingrowth and that methods of using sponges and irrigation with filtered basic salt solution to remove the majority of these ectopic cells reduce the incidence of this complication. Doane and Slade[9] note that microkeratome blade entry at 25 degrees or greater appears to lead to a lower incidence of epithelial ingrowth than a blade entry at or close to 0 degrees.

In this case, however, the patient developed what seemed to be an inflammatory or allergic reaction with a fibrin-like deposition on his epithelium, frank epithelial defects, and redness. These surface epithelial defects may have been related to the epithelial ingrowth that ensued. Indeed, the epithelial ingrowth was positioned beneath the area of epithelial defect.

Successful treatment of the ingrowth requires scraping epithelial cells from the bed and posterior surface of the flap, followed by secure apposition of the flap to the

underlying stroma. In this case, the epithelial ingrowth was successfully removed, as indicated by the topographic analysis, which showed less elevation postoperatively. Thus, epithelial removal achieves dual goals of cleaning the sublamellar interface and smoothing the corneal topography

References

1. Farah SG, Azar DT, Gurdal C, Wong J. Laser in situ keratomileusis: literature review of a developing technique. J Cataract Refract Surg 1998; 24:989–1006
2. Bas AM, Nano HD Jr. In situ myopic keratomileusis results in 30 eyes at 15 months. Refract Corneal Surg 1991; 7:223–231
3. Schultze RL. Accuracy of corneal elevation with four corneal topography systems. J Refract Surg 1998; 14:100–104
4. Belin MW. Intraoperative raster photogrammetry—the PAR Corneal Topography System. J Cataract Refract Surg 1993; 19:188–192
5. Carr JD, Patel R, Hersh PS. Management of late corneal haze following photorefractive keratectomy. J Refract Surg 1995; 11:S309–S313
6. Hersh PS, Schei KS, Irani R. Corneal topography of photorefractive keratectomy versus laser in situ keratomileusis. Ophthalmology 1998; 105:612–619
7. Hersh PS, Abbassi R. Surgically induced astigmatism after photorefractive keratectomy and laser in situ keratomileusis. J Cataract Refract Surg 1999; 25:389–398
8. Helena MC, Meisler D, Wilson SE. Epithelial growth within the lamellar interface after laser in situ keratomileusis (LASIK). Cornea 1997; 16:300–305
9. Doane JF, Slade SG. Complications of lamellar refractive surgery. In: Wu HK, Thompson VM, Steinert RF, et al, eds, Refractive Surgery. New York, NY, Thieme, 1999; 425–426