Unilateral Ectasia After LASIK in a Patient With Abnormal Topography but Normal Tomography

Emmanuel Guilbert, MD; Alain Saad, MD; Damien Gatinel, MD

ABSTRACT

PURPOSE: To report a case of unilateral ectasia developing after LASIK in a patient with abnormal topography but normal tomographic indices.

METHODS: Case report and literature review.

RESULTS: A patient was treated bilaterally for myopia using LASIK. Five years and 5 months postoperatively, unilateral ectasia in the right eye was diagnosed. Preoperatively, anterior curvature (Placido) map of the right cornea showed an asymmetry with 1.8 diopters of steepening when evaluated from upper left to lower right meridians, and a skewing of the steepest radial axes. The calculated KISA% index was 128.4 in the right eye and 5.6 in the left eye. Conversely, posterior elevation map and pachymetry map of the right eye showed no frank abnormalities.

CONCLUSIONS: This case is interesting because it shows that for this patient, the anterior curvature (Placido) map was more sensitive to detect cornea at risk of post-LASIK ectasia than the tomographic features.

[*J Refract Surg.* 2013;29(4):294-296.]

Although uncommon, corneal ectasia is a serious complication after refractive surgery. The most common risk factors include high attempted correction, thin residual corneal thickness, flap creation, and forme fruste keratoconus.[1] We present a patient with abnormal topography but normal tomography of the right eye who underwent bilateral LASIK surgery and developed unilateral ectasia of the right cornea 5 years later.

CASE REPORT

A 34-year-old man presented for refractive surgery at another institution in December 2006. The corrected distance visual acuity was 20/20 in both eyes with a refraction of -6.50 and -7.50 diopters (D) in the right and left eyes, respectively. At the time of consultation, the refraction had been stable for more than 3 years. The patient had no family history of keratoconus and no personal history of allergy or eye rubbing. Biomicroscopy and funduscopy were normal. Corneal topography obtained with the Orbscan II (Technolas Perfect Vision, Munich, Germany) is shown in **Figure 1**. The mean central pachymetry was 599 µm in the right eye (thinnest point 593 µm) and 596 µm in the left eye (thinnest point 590 µm).

The patient had bilateral LASIK surgery in December 2006, without intraoperative complications. A microkeratome (Hansatome; Bausch & Lomb, Rochester, NY) was used to create the flap. The intended flap thickness was 140 µm and the flap diameter was 8.5 mm. Laser ablation was performed using a Technolas 217z excimer laser (Bausch & Lomb). One month postoperatively, the uncorrected distance visual acuity was 20/20 in both eyes. He consulted for the last time in July 2008, 19 months after his surgery, without complaint. Visual acuity was 20/20 (plano) in the right eye and 20/20 (with a refraction of +0.50 -0.50 × 180) in the left eye.

In March 2012, 5 years and 5 months after his surgery, the patient presented with blurring of vision in the right eye. The symptoms had started approximately 3 weeks previously. The corrected distance visual acuity was 20/25 with a refraction of +2.75 -6 × 90 in the right eye and 20/20 with a refraction of +0.25 in the left eye. Combined Placido and elevation topography (**Figure 2**) showed inferior steepening indicative of corneal ectasia in the right eye, whereas topography of the left eye was normal. Anterior segment optical coherence tomography (Visante OCT; Carl Zeiss Meditec, Dublin, CA) showed a flap thickness of 157 µm with a residual stromal bed of 369 µm in the right eye and a flap thickness of 155 µm with a residual stromal bed of 330 µm in the left eye.

To improve his quality of vision, the patient was referred for rigid contact lens fitting.

DISCUSSION

Corneal ectasia is a serious complication after refractive surgery. Progressive asymmetric inferior corneal steepening results in a significant decrease in best corrected visual acuity and may ultimately require corneal transplantation. Although several risk factors are known (the first of them being abnormal preoperative topography), its pathogenesis is not clearly understood.[2]

Previous reports of a large number of cases suggest that patients younger than 25 years with a high degree

From the Department of Cataract and Refractive Surgery, Rothschild Foundation and the Center for Expertise and Research in Optics for Clinicians, Paris, France.

Submitted: August 31, 2012. Accepted: January 22, 2013

Drs. Gatinel and Saad are consultants for Technolas Perfect Vision. The remaining authors have no financial or proprietary interest in the materials presented herein.

Correspondence: Emmanuel Guilbert, MD, Fondation Ophtalmologique Adolphe de Rothschild, Service du Dr. Gatinel, 25 rue Manin, 75019 Paris, France. E-mail: emmanuel.guilbert83@gmail.com

doi:10.3928/1081597X-20130318-09

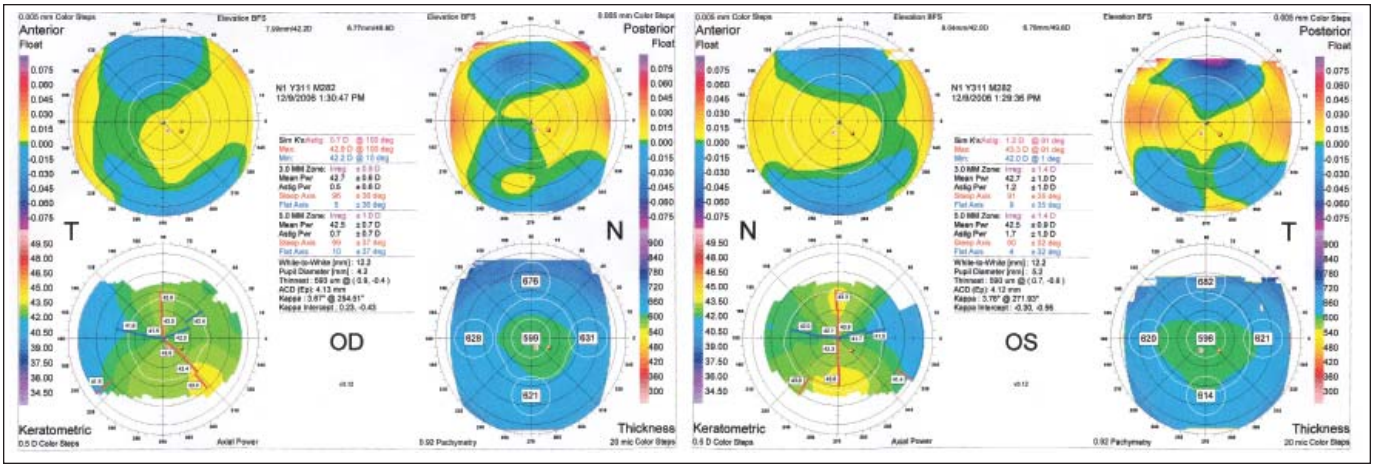

Figure 1. Preoperative combined Placido and elevation topography in the right eye (left) and left eye (right). Topographic aspect of the right cornea shows an asymmetry with 1.8 diopters of steepening when evaluated from upper left to lower right meridians, and a skewing of the steepest radial axes. In addition, there is an asymmetry between the two eyes with the anterior curvature map of the left eye being normal. Posterior elevation map and pachymetry map of the right eye shows no frank abnormalities.

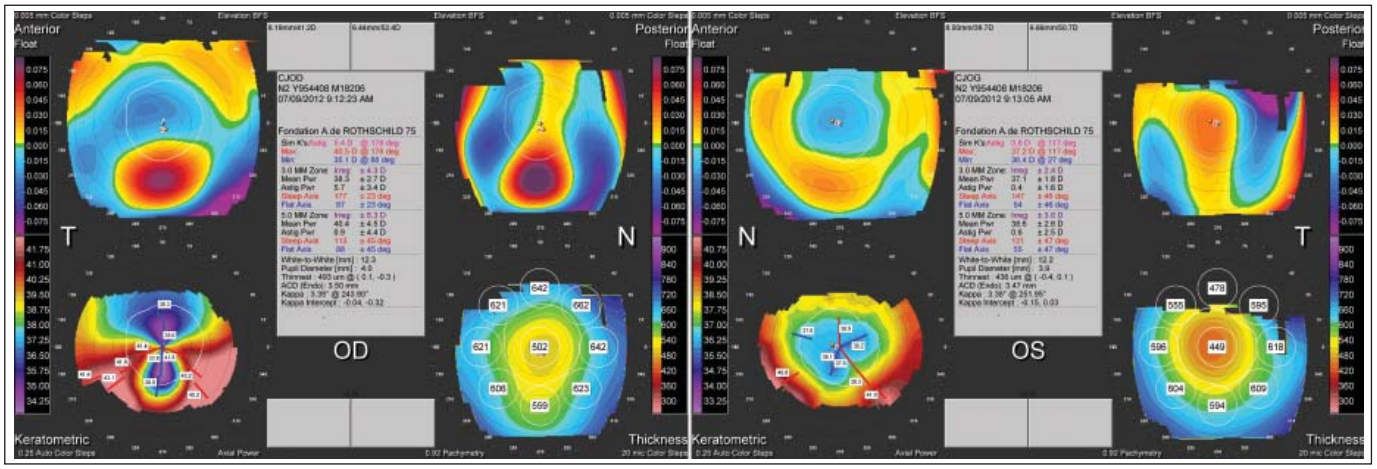

Figure 2. Combined Placido and elevation topography in the right eye (left) and left eye (right), 5 years and 7 months after surgery. Inferior steepening resembling that seen in pellucid marginal degeneration can be observed in the right eye.

of myopia and/or a preoperative corneal thickness of 450 µm or less are at higher risk for post-LASIK ectasia.[3] None of these factors was present in our patient. However, the anterior curvature (Placido) map of the right cornea showed an asymmetry with 1.8 D of steepening when evaluated from upper left to lower right (10 o'clock compared to 4 o'clock) meridians, and a skewing of the steepest radial axes.

In addition, the calculated KISA% index[4] was 128.4 in the right eye and only 5.6 in the left eye (this high KISA% index in the right eye is mostly explained by the weight of the steepest radial axes in the calculation of this score). Although 100 is the reported KISA% cut-off to distinguish between normal and keratoconus, our case did not show an evident clinical sign of keratoconus and it would be more appropriate to label it suspected keratoconus. Thus, the ectasia risk score calculated by Randleman et al.[3] was 3 in the right eye (and 0 in the left eye) according to the topography pattern showing inferior steepening and skewed radial axis, which suggested that this patient was at moderate risk of ectasia after LASIK procedure. However, given the high KISA% index, the right cornea could also be classified as early subclinical keratoconus, and thus the ectasia risk score would be 4 (suggesting a high risk of ectasia after LASIK procedure). This score could therefore be 3 or 4 depending on subjective interpretation of the topography map.

Long-term follow-up of normal fellow eyes of patients with unilateral keratoconus showed that a significant number of patients with the asymmetric bow-tie/steepest radial axes pattern in their clinically normal eye ultimately progress to keratoconus.[5] Finally, there was an asymmetry between the two eyes with the

anterior curvature map of the left eye being normal. Thus, based on Placido-imaging, corneal topography of the right eye of our patient was abnormal and the LASIK indication should have been reconsidered.

The preoperative posterior elevation map and pachymetry map of the right eye, which experienced ectasia, showed no frank abnormalities. The posterior elevation map of the right cornea showed a mild area of protrusion of the posterior surface at the 6- to 7-o'clock positions, 3.5 mm away from the center. Lim et al.[6] found that the mean values of maximum posterior elevation and irregularity were significantly higher in eyes with keratoconus and suspected keratoconus. Other authors have highlighted the involvement of the posterior surface even in the initial stage of keratoconus.[7,8] The pachymetry map showed an asymmetry between inferior and superior peripheral corneal thickness, pachymetry being 55 µm thicker in the superior cornea (3 mm away from the center) than in the inferior cornea, which is greater than what is usually observed in normal subjects.[9,10] Furthermore, there was no significant difference in central corneal thickness between eyes, which has also been reported as a possible risk factor for ectasia.[11]

Anterior segment optical coherence tomography showed that flap thickness of our patient was not abnormally thick. This is in agreement with a recent study of 50 eyes of 29 patients,[12] which found that measured central flap thickness was not thicker than estimated in most eyes developing ectasia after LASIK, and that excessively thick flaps do not appear to be a major contributing factor to the pathogenesis of ectasia after LASIK.

A careful retrospective analysis of the preoperative topographies of our patient suggests that he would have been excluded from surgery based on topography alone, given a conjunction of anterior curvature abnormalities on the Placido map of the right cornea, which clearly demonstrated the unilateral abnormality. In contrast, tomographic features (elevation and pachymetry maps) failed to show significant anomalies, and thus were less sensitive to detect cornea at risk of post-LASIK ectasia in the case of our patient.

AUTHOR CONTRIBUTIONS

Study concept and design (DG, EG); data collection (DG); analysis and interpretation of data (AS); drafting of the manuscript (EG); critical revision of the manuscript (DG, AS); supervision (DG)

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