CASE REPORT

Unilateral corneal ectasia after small-incision lenticule extraction in a 43-year-old patient

Jean Christophe Gavrilov, MD, Raphael Atia, MD, Vincent Borderie, MD, PhD, Laurent Laroche, MD, Nacim Bouheraoua, MD, PhD

Unilateral corneal ectasia developed after small-incision lenticule extraction for mild myopia in a 43-year-old man with preoperative asymmetric astigmatism. The ectasia was diagnosed 4 years postoperatively. Preoperative data showed asymmetric astigmatism with no signs of forme fruste keratoconus. Inferior anterior curvature steepening exceeded 2.00 diopters without bulging of the posterior curvature, and pachymetric thickness exceeded 515 µm. Corneal ectasia can occur after small-incision lenticule extraction in patients older than 40 years with preoperative asymmetric astigmatism.

J Cataract Refract Surg 2018; 44:403–406 © 2018 ASCRS and ESCRS

Since the first description of small-incision lenticule extraction (SMILE, Carl Zeiss Meditec AG) in 2011 by Sekundo et al.,[1] the number of procedures performed to correct myopia and astigmatism with this new technique has steadily increased. The incidence of corneal ectasia after laser in situ keratomileusis (LASIK) has been estimated at 1 in 2500.[2] Because small-incision lenticule extraction is a flapless procedure, it has been suggested that the risk for corneal ectasia after small-incision lenticule extraction is lower than after LASIK.[3] To date, 4 reports of corneal ectasia have been published.[4–8] We report a case of unilateral corneal ectasia 4 years after small-incision lenticule extraction for mild myopia in a patient older than 40 years with preoperative asymmetric astigmatism.

CASE REPORT

A 43-year-old man had small-incision lenticule extraction in both eyes in 2013. The preoperative refraction was −3.75 −1.25 × 5 in the right eye and −5.25 −0.75 × 180 in the left eye. The corrected distance visual acuity (CDVA) was 20/20 in both eyes. The patient had no family history of keratoconus. Before surgery, the central corneal thickness was 524 µm in the right eye and 517 µm in the left eye, with minimal thickness of 522 µm and 515 µm, respectively, measured with a rotating Scheimpflug camera (Pentacam, Oculus Optikgeräte GmbH) (Figure 1). Preoperative topography analysis showed the presence of asymmetric astigmatism with an elevated area on the inferior anterior corneal surface in both eyes, representing a steepening of more than 2.00 diopters (D) in the right eye and 1.80 D in the left eye. Moreover, Scheimpflug camera images showed an absence of posterior curvature bulging and no correspondence between the steeper anterior curvature and the thinner points of the cornea.

Small-incision lenticule extraction was performed uneventfully with the Visumax femtosecond laser system (Carl Zeiss Meditec AG). The caps were 7.30 mm in diameter and 120 µm thick in both eyes. The diameter of the optical zone was 6.50 mm in both eyes. The maximum and minimum lenticule thicknesses were 94 µm and 15 µm, respectively, in the right eye and 109 µm and 15 µm, respectively, in the left eye, with a residual stromal bed (RSB) of 308 µm in the right eye and 286 µm in the left eye. The immediate postoperative course was uneventful, with an uncorrected distance visual acuity of 20/20 in both eyes at the 1-month examination.

Four years after the initial small-incision lenticule extraction, the patient reported vision loss in the right eye. The CDVA was 20/40 with −1.75 −1.50 × 60 in the right eye and 20/20 with −0.25 −0.25 × 65 in the left eye. The corneal thickness at the thinnest point, determined by Scheimpflug pachymetry, was 407 µm in and 418 µm, respectively. Ectasia was clearly visible in the right eye, which showed posterior bulging and an inferior steepening of more than 8.00 D. Figure 2 shows topographies with ectasia present. Standard corneal crosslinking (CXL) with a 3 mW treatment for 30 minutes was performed in the patient's right eye. After 6 months, the topographies remained stable (Figures 3 and 4).

DISCUSSION

To our knowledge, this is the fifth report of corneal ectasia after small-incision lenticule extraction and the first report

Submitted: December 21, 2017 | Final revision submitted: January 21, 2018 | Accepted: January 29, 2018

From the Quinze-Vingts National Ophthalmology Hospital (Gavrilov, Atia, Borderie, Laroche, Bouheraoua) and the Institut de la Vision (Borderie, Laroche, Bouheraoua), UPMC-Sorbonne Universities, INSERM, CNRS UMR 7210, Paris, France.

Corresponding author: Nacim Bouheraoua, MD, PhD, Centre Hospitalier National d'Ophtalmologie des Quinze-Vingts, 28, rue de Charenton, Paris 75012, France. E-mail: nacim.bouheraoua@gmail.com.

0886-3350/$ - see frontmatter
https://doi.org/10.1016/j.jcrs.2018.01.021

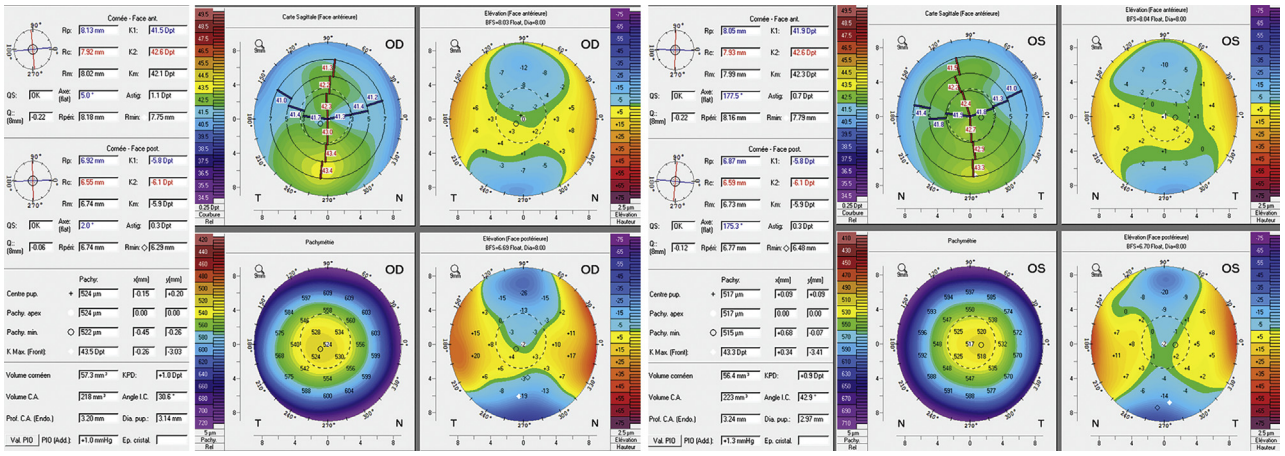

Figure 1. Scheimpflug-based corneal topography showing sagittal map, pachymetry map, anterior elevation map, and posterior elevation map before small-incision lenticule extraction (N = nasal; T = temporal).

of a patient older than 40 years.[4–8] Two previous reports[4,5] were of cases of ectasia after small-incision lenticule extraction with preoperative signs of forme fruste keratoconus; however, ectasia has also been observed in patients with normal preoperative data.[6] Mattila and Holopainen[7] reported a case of bilateral ectasia after small-incision lenticule extraction in which 1 eye had signs of keratoconus before surgery, whereas the preoperative data for the contralateral eye were normal.

Retrospectively, a diagnosis of forme fruste keratoconus was discussed. The preoperative data showed the presence of asymmetric astigmatism without the posterior elevation of the cornea that is considered to be an early indicator of keratoconus. The optimum cutoff point for posterior corneal elevation for distinguishing forme fruste keratoconus from normal corneas on Scheimpflug analysis is 29 µm or 16 µm on scanning-slit corneal topography analysis (Orbscan IIz, Bausch & Lomb, Inc.).[2,9]

The patient presented with a clear case of ectasia of the right eye, which showed posterior bulging and inferior steepening of more than 8.00 D. In contrast, postoperative Scheimpflug images in the left eye showed an absence of features typical of ectasia with no posterior bulging. However, the left eye has required frequent topographic monitoring so that CXL can be performed if ectasia develops.

Several studies have reported ectasia after LASIK in patients with and without predisposing factors.[2] The cornea is a complex anisotropic composite with nonlinear elastic and viscoelastic properties. The anterior cornea and peripheral cornea are the strongest parts of this structure because of their higher levels of intralamellar collagen branching. The posterior and central parts of the cornea are weaker. Small-incision lenticule extraction is a flapless procedure and preserves the collagen networks of the anterior stroma that account for 60% of the total corneal tensile strength.[8,10] It has therefore been suggested that this procedure damages the biomechanical properties of the cornea to a lesser extent than femtosecond laser–assisted LASIK.[11] A finite-element model for theoretical comparison of the distribution of corneal stress after LASIK and small-incision lenticule extraction treatments has been used by Sinha Roy et al.[12] According to this model, stress increases on the posterior cornea and decreases on the anterior cornea after LASIK. In contrast, the distribution of stress after small-incision lenticule extraction simulation more closely resembles the geometric analog model. It has been suggested that changes in the distribution of stress after LASIK increase the risk for corneal ectasia to a greater extent than small-incision lenticule extraction.[13]

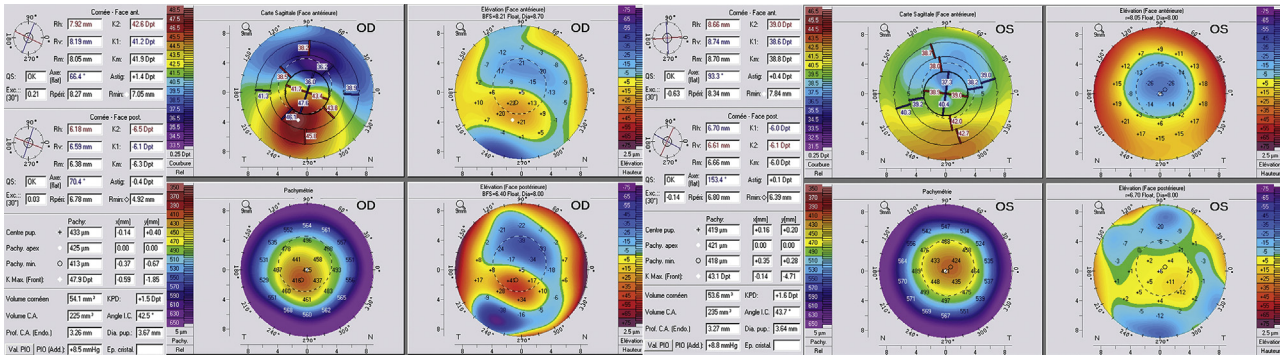

Figure 2. Scheimpflug-based corneal topography showing sagittal map, pachymetry map, anterior elevation map, and posterior elevation map 4 years after small-incision lenticule extraction (N = nasal; T = temporal).