Keratectasia Induced by Laser in situ Keratomileusis in Keratoconus

Clair-Florent M. Schmitt-Bernard, MD; Cécile Lesage, MD; Bernard Arnaud, MD

ABSTRACT

PURPOSE: Corneal thinning disorders weaken the mechanical strength of affected corneas, suggesting that photorefractive procedures may be contraindicated in keratoconus. Few cases have been reported to confirm this hypothesis.

METHODS: A 45-year-old man had two laser in situ keratomileusis (LASIK) procedures and one photorefractive keratectomy (PRK) performed on his left eye, and three LASIK procedures on his right eye. After these surgeries, a dramatic corneal ectasia and grade III haze occurred in both eyes, with a clinical diagnosis of keratoconus. The changes in his corneas were followed with videokeratography and slit-lamp microscopy.

RESULTS: Preoperative videokeratograph of both eyes suggested keratoconus. After multiple refractive procedures, the best spectacle-corrected visual acuity was as low as 20/1200 bilaterally. Both eyes displayed dramatic corneal protrusion with corneal scarring.

CONCLUSIONS: This case emphasizes the need for preoperative corneal thickness measurement and detailed analysis of videokeratographs. Thinning corneal disorders such as keratoconus, keratoconus suspects, or pellucid marginal degeneration are a contraindication for excimer laser ablative refractive procedures. [*J Refract Surg* 2000;16:368-370]

A variety of corneal disorders are known to weaken the mechanical strength of affected corneas, suggesting that photorefractive procedures that further thin the cornea may induce keratectasia. We describe one patient who had this adverse effect. Corneal thinning disorders should remain a contraindication to photorefractive procedures.

From the Department of Ophthalmology, CHU Montpellier, France

The authors have no proprietary interest in the materials mentioned.

Correspondence: Dr. Clair-Florent Schmitt-Bernard, Service d'ophtalmologie, CMC Gui de Chauliac, 80 avenue Augustin Fliche, 34295 Montpellier Cedex 5, France. Tel: 33.4.67337169; Fax: 33.4.67541065; E-mail: <cfsb@mail.mnet.fr> or <cfsb@mail.igh.cnrs.fr>

Received: July 23, 1999

Accepted: February 11, 2000

CASE REPORT

A 45-year-old-man was referred to our department for keratectasia and severe haze in both eyes following multiple excimer laser refractive procedures for myopia. The refraction in both eyes showed progressively increasing myopia and astigmatism since 1976 that had remained stable during the year before surgery. His best spectacle-corrected visual acuity before any refractive procedure was as low as 20/40 in his right eye and 20/50 in his left eye with soft contact lenses of -8.50 diopters (D) and -10.00 D, respectively. Slit-lamp microscopy did not exhibit any feature characteristic of a corneal thinning disorder in either eye.

We report the history of his left eye as it was more fully documented. Two laser in situ keratomileusis (LASIK) procedures and one photorefractive keratectomy (PRK) procedure for high myopia and astigmatism were completed with a broad-beam excimer laser (Bausch & Lomb Technolas Keracor 117C, Dornach, Germany). The first LASIK was performed for -11.00 D using a multizone photoablation procedure (corneal flap: 160-mm ablation zone: 7-mm diameter, 118-µm depth) in July 1996. Follow-up showed partial myopic regression leading to a second LASIK procedure for residual myopia, associated with elliptic photoablation for the initially uncorrected astigmatism (-4.50 +6.00 x 25°; ablation zone: 5-mm diameter, 77-µm depth) in September 1997. One month later, PRK was performed on the LASIK flap for residual myopia and astigmatism (-1.00 +4.25 x 20°; ablation zone: 5-mm diameter, 18-µm depth). Since then, the evolution has shown a

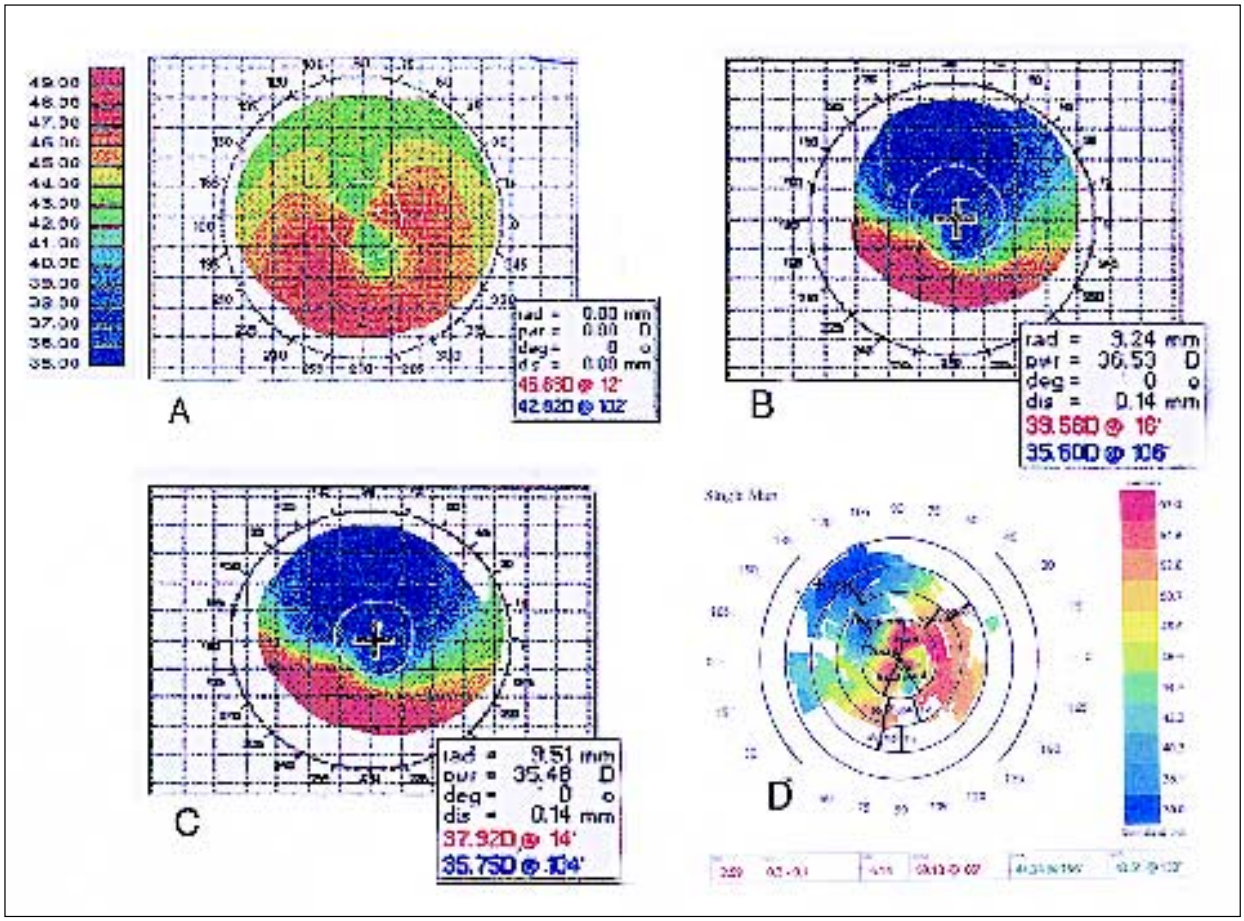

Figure. Left eye. Preoperative videokeratograph shows **(A)** keratoconus pattern characterized by an inferior steepening up to 49.00 D, I-S > 1.4, and normal topographic values in the superior area (EyeSys), **(B)** flattening of the central superior corneal area (35.00 D) after the first LASIK procedure (EyeSys) and **(C)** second LASIK procedure (EyeSys). **(D)** The keratometric value in the inferior cornea remained unchanged (49.00 D); central keratectasia up to -63.00 D, 9 months following PRK (TMS-2, Tomey).

dramatic ectasia linked to considerable corneal thinning of his left cornea, associated with corneal haze grade III located at the interface and in the remaining corneal flap after the PRK procedure, resulting in 20/1200 best spectacle-corrected visual acuity.

RESULTS

Analysis of preoperative videokeratography of his left eye (Fig 1A) strongly suggested a diagnosis of keratoconus with an inferior corneal steepening up to 49.00 D and a Rabinowitz index I – S > 1.4. Myopia was -11.00 D and the average central corneal astigmatism was 4.00 D. Therefore, the poorer soft contact lens-corrected visual acuity could be due to the uncorrected astigmatism. The videokeratograph of his right eye disclosed the same pathologic pattern of keratoconus. Preoperative corneal thickness measurement was not performed by the surgeon, which could have enabled a diagnosis of a corneal thinning disorder. Pachymetry was not performed between each of the photoablation procedures. The first LASIK performed on his left eye resulted in a flattening of the central and superior corneal area (35.00 D), with no significant modification of the inferior steepening (49.00 D), nor the average central astigmatism, because the spheric photoablation reproduced the corneal irregularity (Fig 1B).

The second LASIK procedure did not induce any obvious topographic corneal modification but did enlarge the flattened central and superior corneal area (Fig 1C). The cornea remained clear at this stage of surgery.

Persistent astigmatism led the surgeon to perform PRK on the corneal flap, inducing a dramatic

steepening in the center of the cornea and strong dense haze involving the interface and the entire corneal flap, resulting in severe loss of vision (Fig 1D). The patient's right cornea also became ectatic as the surgeon conducted multiple refractive procedures. These effects resulted in the patient's inability to work. A penetrating keratoplasty is planned in the left eye.

DISCUSSION

It has been postulated that excessive photoablation may induce keratectasia in a normal cornea, and usually appears in the center of the cornea. This patient developed dramatic bilateral keratectasia in the center of the cornea following a stromal photoablation of 195 µm left eye and 126 µm right eye. This is less than the usually advisable limit of ablation (250 µm) needed to prevent this adverse effect on a cornea of normal pachymetric value. Analysis of preoperative videokeratography strongly suggested bilateral keratoconus. The central keratectasia in this case may have been induced by excessive excimer laser ablation on corneas whose strength was weakened by keratoconus.

The corneal haze associated with the keratectasia in his left eye may have been a consequence of the PRK performed on the flap, which we think is contraindicated after LASIK because of the high incidence of corneal scarring. Nevertheless, the physiopathology of the haze in this case remains uncertain since the right eye showed similar interface and corneal flap scarring after LASIK procedures without PRK.

Forme fruste of keratoconus may be difficult to diagnose in the case of astigmatism with an asymmetric bowtie pattern on the videokeratograph.

Two cases of keratectasia after excimer laser photoablation for myopia and astigmatism have been linked to keratoconus suspect.[1,2] These cases and the case reported here strongly suggest that these conditions should remain a contraindication to ablative refractive procedures. Additive refractive procedures such as epikeratoplasty may be considered in these cases, as it has demonstrated its architectonic and refractive efficiency in thinning disorders.[3,4] However, this type of procedure for high myopia has poor refractive predictability and stability compared with LASIK on a normal cornea.

REFERENCES

1. Seiler T, Quurke AW. Iatrogenic keratectasia after LASIK in a case of forme fruste keratoconus. J Cataract Refract Surg 1998;24:1007-1009.
2. Seiler T, Koufala K, Richter G. Iatrogenic keratectasia after laser in situ keratomileusis. J Refract Surg 1998;14:312-317.
3. Waller SG, Steinert RF, Wagoner MD. Long-term results of epikeratoplasty for keratoconus. Cornea 1995;14:84-88.
4. Choi S, Lee JH. Epikeratoplasty for myopia: 2-year results and a proposed nomogram. J Refract Surg 1995;11:497-501.