

Refractive Surgery Disasters

A variety of adverse outcomes after corneal refractive surgical procedures are reviewed with an emphasis on avoidance and therapeutic options.

BY SHERAZ M. DAYA, MD, FACP, FACS, FRCS(Ed)

Refractive mishaps following corneal procedures typically result in corneal irregularity, opacification, or both. Although corneal irregularity can be treated with a rigid contact lens, opacification requires removal by ablation or grafting. Avoiding these problems is essential, however, as with any surgical procedure it is inevitable to incur a small number of adverse and unexpected complications.

IRREGULAR ASTIGMATISM

The causes for irregular astigmatism following LASIK include flap complications such as buttonholes and partial or fragmented flaps. After ablative refractive procedures like LASIK, LASEK (Figure 1A), and PRK, ectasia can arise, causing irregular astigmatism. Ectasia can also occur after incisional refractive surgery such as radial keratotomy (RK) (Figure 1B). Additionally, decentrations and ablations in spite of a partial flap can lead to irregular astigmatism as can inflammation such as diffuse interlamellar keratitis (Sands of the Sahara) and microbial keratitis.

OPACIFICATION

The aforementioned postoperative LASIK flap complications with subsequent scarring (Figure 2) can produce postoperative opacification. Other causes of opacity include postoperative surface ablation haze, scarring, and stromal outgrowth or “sub-epithelial fibrosis” following incisional surgery. As mentioned earlier, inflammation such as diffuse interlamellar keratitis or microbial keratitis can cause corneal scarring. Sporadic cases of atypical mycobacterial keratitis have been reported,^{1,2} and, because of the nature of this organism, it is frequently diagnosed late, requires prolonged treatment, and often requires flap amputation. These cases result in both opacification and corneal irregularity.

MANAGEMENT

The best noninvasive option for managing irregular astigmatism is a rigid contact lens, but it is typically not a favored option in a refractive surgery patient who has electively chosen vision correction. Opacification requires the

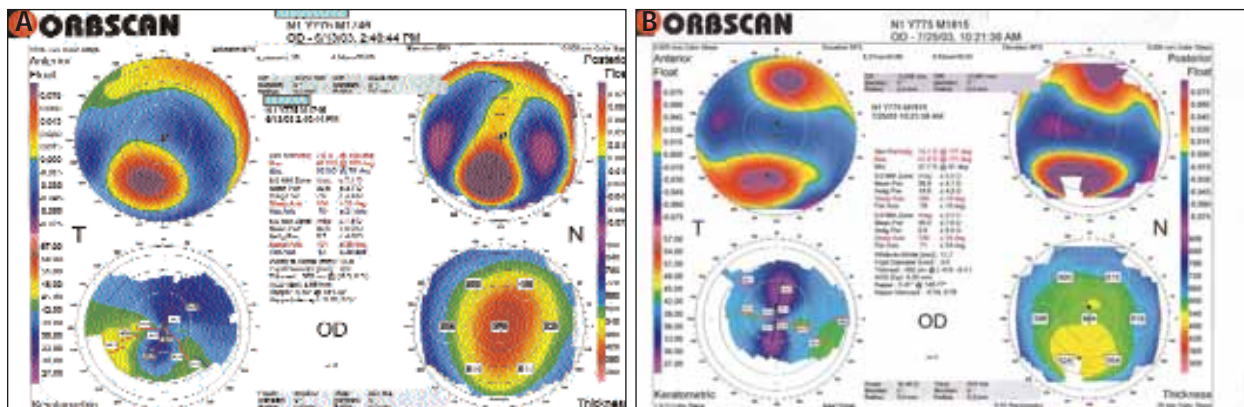


Figure 1. Ectasia can be detected following procedures such as LASEK by using topography (A). Post-LASEK ectasia can cause irregular astigmatism. The same complication can occur after RK (B).

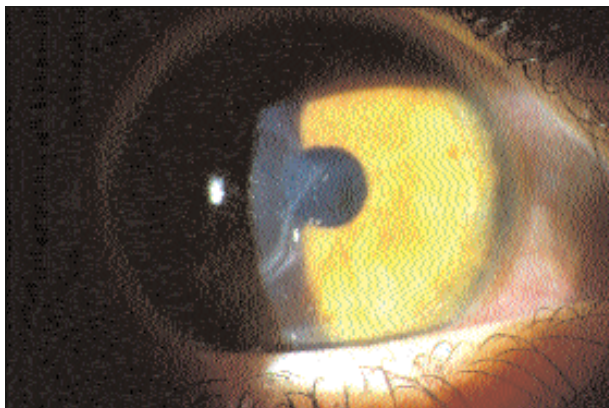


Figure 2. Post-LASIK flap complications such as buttonholes and partial or fragmented flaps can cause opacification.

removal of the opaque tissue, depending on its extent, by way of further ablation or excision and replacement by a grafting technique.

Many surgeons electively use mitomycin C (MMC) to prevent haze. This technique seems to be effective, but there is little scientific evidence demonstrating its long-term safety. MMC 0.02% is effective when used in conjunction with phototherapeutic keratectomy (PTK) for the elimination of superficial scarring. I have used MMC successfully in this context with a total application time of 15 seconds, rather than 2 minutes. Figure 3A shows scarring from an occult buttonhole post-LASIK (UCVA of 20/40, treated by PTK and a 15-second application of MMC). Figure 3B shows an eye 6 months after treatment that achieved 20/15 UCVA.

What options are available in cases of extreme irregularity and deeper opacification or where there is reduced corneal thickness? An alternative that I favor is a homoplasic automated lamellar thera-

peutic keratoplasty (ALTK). This procedure involves using a microkeratome to remove the anterior cornea and replacing it with a similarly fashioned flap from a donor globe or cornea. Commercially, the Moria ALTK system (Moria, Antony, France) is available specifically for this purpose. I adapted the Automated Corneal Shaper microkeratome (Bausch & Lomb, Rochester, NY) and designed an artificial anterior chamber to enable flap creation from donor corneal discs (Figure 4). The advantage of this technique is I am able to remove the anterior cornea and replace it with a donor of predetermined thickness by changing the thickness plate. This method is useful for removing corneas that have anterior opacification and those with relatively fine irregularities. Figure 5 shows an eye that underwent RK followed by PRK and developed severe scarring. I performed a homoplasic ALTK procedure, and, after the patient achieved refractive stability at 18 months, I performed LASIK to correct the residual refractive error. The eye now has a UCVA of 20/30 and a BSCVA of 20/20.

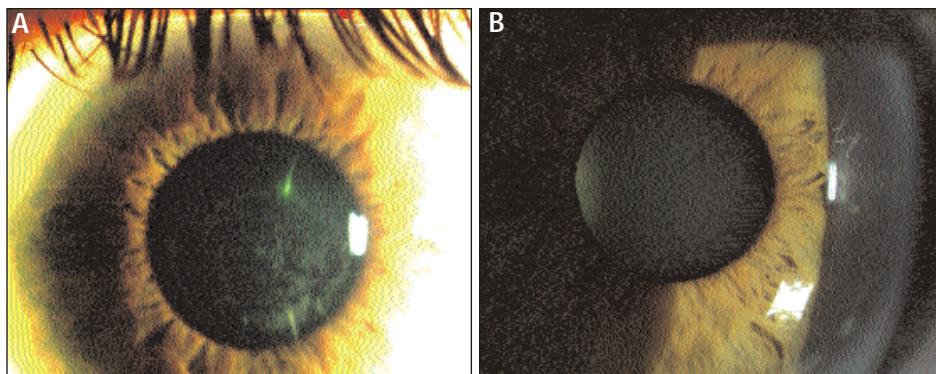


Figure 3. The author treats an eye with scarring from a post-LASIK occult button with PTK and a 15-second application of MMC (A). After treatment, a patient can achieve improved UCVA (B).

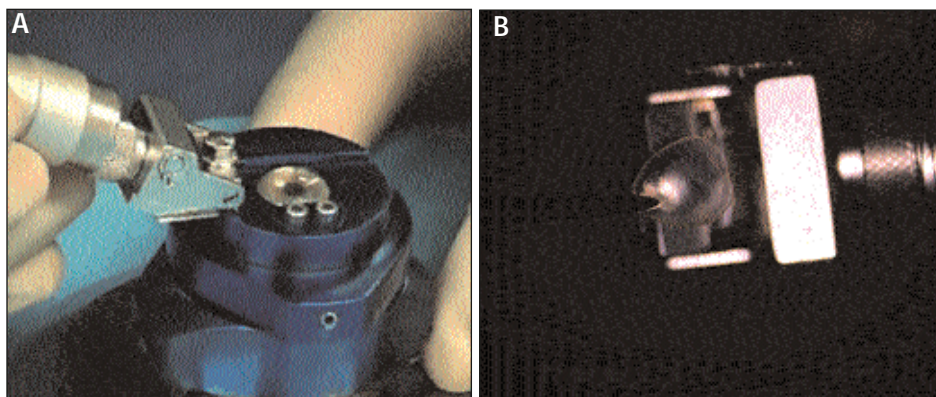


Figure 4. The author adapted the Automated Corneal Shaper microkeratome (A and B) to perform homoplasic ALTK in eyes with deep, irregular opacification or where corneal thickness is reduced.

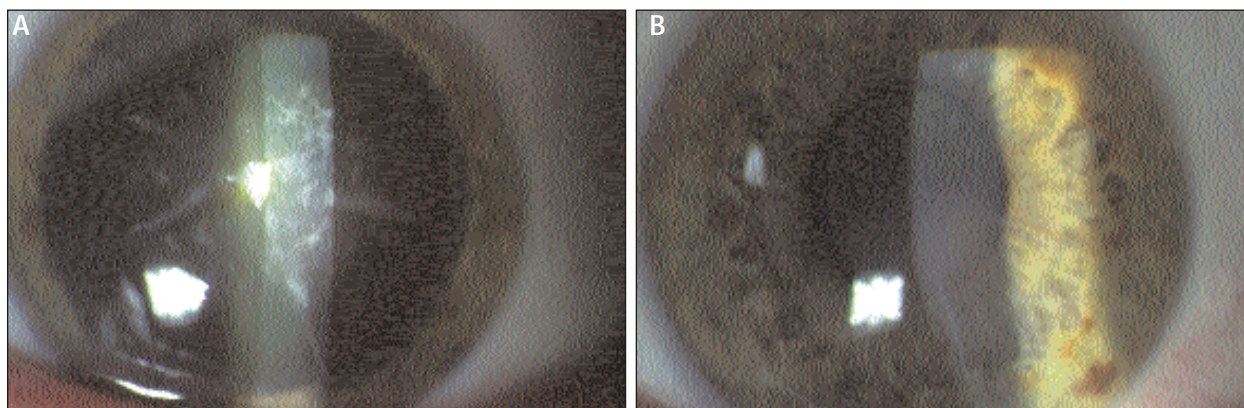


Figure 5. PTK following RK can cause severe corneal scarring (A). The author performed homoplastic ALTK and then LASIK after refractive stability was achieved. Postoperative UCVA and BSCVA were 20/20 (B).

When a cornea is too thin for a flap resection, a PTK can be performed, and a lamellar flap can be added to the epithelialized surface to prevent further scarring, provide more corneal substrate, and make future ablative refractive surgery possible.

ECTASIA

Ectasia remains a problem. It occurs in corneas predisposed to the condition. Corneal refractive surgery is best avoided in corneas with inferior steepening. Additionally, surgeons should maintain a high index of suspicion for thin and steep corneas with a steep posterior float on Orbscan topography (Bausch & Lomb). Because of variation in flap thickness,³ I advocate measuring the corneal bed's thickness following flap resection and prior to laser ablation in cases of a thicker-than-expected flap. I believe this process should be standard practice. Recently, two cases of ectasia with flaps thicker than 220 μ m on ultrasound biomicroscopy were referred to me.

Although contact lenses remain the mainstay of treatment, there have been reports⁴ of using intracorneal rings,

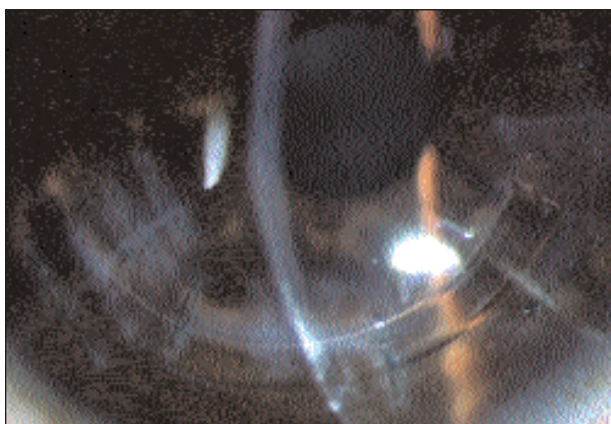


Figure 6. The author used Intacs to treat post-RK ectasia.

either Intacs (Addition Technology, Inc., Des Plaines, IL) or Ferrara rings (Mediphacos Ltd., Belo Horizonte, Brazil) to stabilize and flatten the cornea. The long-term effect of these rings is unknown, but the devices are worthy of consideration prior to corneal grafting. Figure 6 shows an eye after RK with inferior ectasia initially sutured with some early effect. This same patient later benefited from the implantation of a single Intacs ring.

In the long term, collagen crosslinking may play a role in the prevention as well as the treatment of ectasia by strengthening the cornea and averting the progression of the ectatic condition.⁵

With improved keratomes and the advent of the Intralase FS laser (Intralase Corp., Irvine, CA), the prevalence of refractive surgery disasters will decrease. Luckily, there are a number of options available for the correction of such catastrophes. However, ultimately, many patients may still require a deep lamellar or penetrating keratoplasty. ■

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