Corneal Scarring After Refractive Surgery

Sutureless amniotic membrane contact lenses are a noninvasive option by which to facilitate corneal healing.

BY MARC MOORE, MD; ALEKSANDAR STOJANOVIC, MD; LANCE J. KUGLER, MD; AND MING WANG, MD, PHD

CASE PRESENTATION

A 36-year-old man underwent surface ablation for bilateral moderate myopia with astigmatism. Unfortunately, he developed unilateral keratitis in his left eye on the second postoperative day. The eye had a central epithelial defect that measured 2 × 1.5 mm with significant inflammatory infiltrate, edema in the surrounding stroma, endothelial precipitates, and grade 1 flare in the anterior chamber. Cultures came back positive for *Staphylococcus aureus*.

The patient was initially treated with topical antibiotics and later with steroids, according to the standard protocol. The infection cleared, but significant central subepithelial scarring and a marked increase in higher-order aberrations (root mean square error ≥ 2 µm at 5 mm; Figures 1 and 2) developed, inducing a 2.00 D hyperopic shift. At the 2-month postoperative visit, the patient's UCVA had improved to 20/25 from count fingers at 4 inches on the day the keratitis was diagnosed.

My plan is to perform a transepithelial topography-guided customized ablation 6 months after the original procedure to achieve corneal optical regularization by treating the higher-order aberrations and the hyperopic shift and to reduce the area of superficial stromal scarring. Would you consider using an amniotic membrane contact lens (AMCL) for this eye with corneal scarring after refractive surgery?

—Case prepared by Aleksandar Stojanovic, MD.

Figure 1. Appearance of the eye at the 2-month postoperative visit.

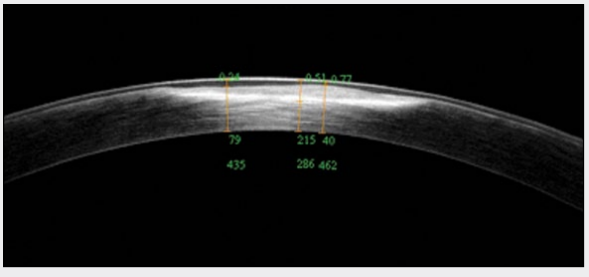

Figure 2. Anterior segment optical coherence tomography scan shows a corneal scar at the 2-month postoperative visit.

MING WANG, MD, PHD

The key to removing a corneal scar, especially after surface ablation, is to control the refractive outcome and minimize the amount of scar formation after phototherapeutic keratectomy (PTK) by reducing inflammation and facilitating epithelial regrowth. AMCLs have been shown to help corneal wound healing, reduce corneal scarring, and treat ocular surface disease by[1-3]

- Reducing keratocyte apoptosis and polymorphonuclear cell infiltration and inflammation
- Inhibiting matrix metalloproteinase, which is directly related to a variety of corneal basement membrane and epithelial dystrophies
- Inhibiting transcription growth factor-β signal transduction in corneal and conjunctival fibroblasts to prevent scarring
- Reducing the expression of various growth factors and proinflammatory cytokines such as the interleukin-1 receptor
- Releasing antiinflammatory cytokines such as interleukin-10
- Promoting antiangiogenic activity
- Retaining some antimicrobial properties
- Facilitating epithelialization
- Reducing pain

For these reasons, I would use an AMCL in combination with PTK in this case.

The surgical delivery of an AMCL with sutures has many shortcomings, including surgical trauma and the risk of perforation and infection. In recent years, nonsurgical AMCL delivery systems have been developed, including AmbioDisk (IOP Ophthalmics; Figure 3) and Prokera (BioTissue). The standard protocol for applying an AMCL is 2 weeks with low-dose steroid eye drops twice daily, nonsteroidal antiinflammatory drugs once daily, and, if indicated, antibiotic eye drops three times daily.

LANCE J. KUGLER, MD

Unfortunately, this patient developed one of the dreaded complications after refractive surgery—corneal ulceration leading to scar formation. I, too, would recommend PTK to remove an existing corneal scar along with an AMCL to reduce the amount of new scar formation.

Sutureless AMCLs have become an essential tool for managing anterior corneal conditions and other corneal conditions, especially when used in conjunction with PTK. I use an AMCL as a first-line treatment for epithelial basement membrane dystrophy (EBMD) in the setting of recurrent corneal erosions. AMCLs allow the corneal surface to repair itself, which, in my experience, often reduces the need to progress to PTK or superficial keratectomy, and a tarsorrhaphy is rarely required. AMCLs also reduce the irregularities on the corneal surface and, in my experience, improve the accuracy of keratometry and topography, thus allowing for more precise IOL calculations prior to cataract surgery.

I have had success treating severe dry eye disease with sutureless AMCLs. I have a few dry eye patients who have benefited from the application of an AMCL every 6 months, because it stabilizes the ocular surface and permits the epithelium to heal. Once the AMCL is removed, however, the challenge is maintaining the health of the ocular surface with topical and systemic treatments.

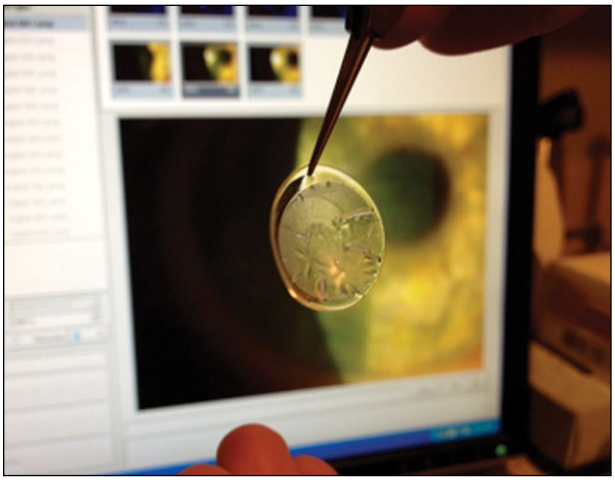

Figure 3. The AmbioDisk AMCL.

MARC MOORE, MD

My colleagues and I conducted a retrospective review of 59 AMCL treatment episodes for 44 eyes of 39 consecutive patients with a persistent keratoepithelial defect (KED) or epitheliopathy over an 18-month period. This study was performed in a high-volume corneal referral practice. The patients were divided into a medical group (KED due to alkaline burn, herpes simplex, EBMD, Sjögren syndrome, or keratoconus) and a postsurgical group (persistent KED after PTK for corneal opacity and pterygium removal). Each AMCL was scheduled to remain on the eye for approximately 2 weeks, and additional AMCLs were used if clinically indicated. A treatment episode was considered successful if it resulted in the closure of the KED.

Overall, 83 AMCLs were used for the 59 episodes of KED. Fifty of 59 episodes (84.7%) achieved KED closure, with an average of 1.4 AMCLs used (mean treatment period, 3.5 weeks). Nine treatment failures occurred in eyes with the most advanced ocular surface diseases (KED due to sterile corneal ulceration, EBMD, Sjögren syndrome, and bullous keratopathy). In the medical group, 79.5% (35/44) of KEDs achieved closure with an average of 2.3 AMCLs used (mean treatment period, 5.7 weeks). In the postsurgical group, 100% (15/15) of KEDs healed successfully with an average of 1.1 AMCLs (mean treatment period, 2.8 weeks).

Based on these results, AMCLs appear to be effective in promoting the healing of persistent keratoepithelial defects due to a wide array of ocular surface diseases and

corneal surgery. On average, between one and two AMCLs are typically needed to close a KED, with an average AMCL treatment period of 2 to 3 weeks. Eyes with more advanced disease require 5 to 6 weeks of treatment on average.

In my opinion, a sutureless AMCL would benefit this patient in at least two ways. First, it would help ensure KED closure after PTK. Second, its effects on corneal fibroblasts would likely decrease the risk of secondary scar formation and give the patient the best possible outcome. ■

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