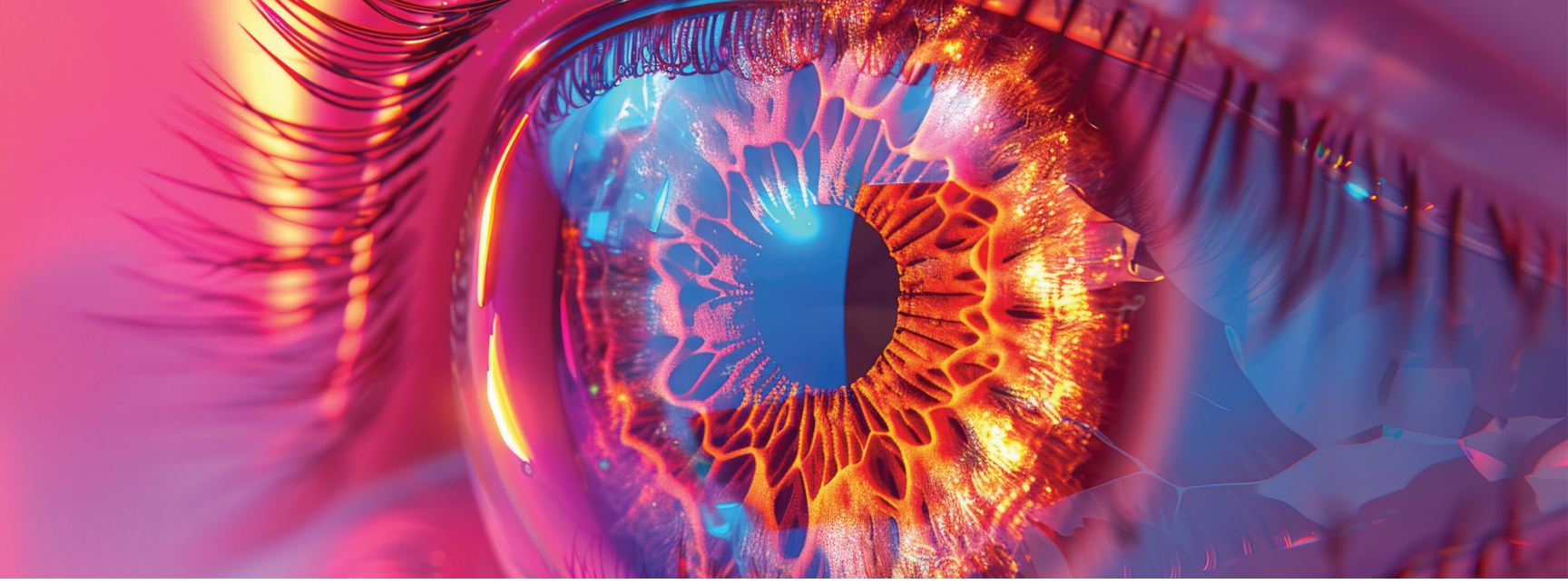

CORNEAL ENDOTHELIAL DISEASE INTERVENTION

A review of current surgical options.

BY KRISTEN WALTON, OD, FAAO

In 2022, a global systematic review on the prevalence of Fuchs corneal dystrophy (FCD) revealed that little more than 7% of the world's population is affected by the condition, with a higher probability of occurrence in patients of European descent.[1] The early presentation of FCD in clinical practice can be subtle; the only finding may be a few scattered guttae (Figures 1 and 2) in an otherwise asymptomatic patient. As the disease process progresses, patients notice changes in their vision—anything from foggy vision in the morning that improves throughout the day, to decreased clarity and contrast sensitivity, and/or reduced comfort and increased light scatter, especially when driving at night. Patients with severe disease can no longer perform activities of daily living without visual interference. Additionally, their eyes are typically uncomfortable due to repeated ruptured bullae caused by excessive stromal swelling.

Timely treatment for patients with FCD is key, as it can stave off progression, minimize discomfort, and enhance patient quality of life. All available treatments are viable options; it's just a matter of tailoring the treatment to the patient and the stage at which they present.

WEIGHING THE TREATMENT OPTIONS

For a while, penetrating keratoplasty (PKP) was the only option for patients with late-stage FCD, but now it is rarely performed due to better options with earlier intervention. PKP can require a year-long recovery to reach BCVA with stringent restrictions. Next came the advent of Descemet stripping endothelial keratoplasty (DSEK) in the early 2000s and then Descemet membrane endothelial keratoplasty (DMEK) in 2006.[2] A DSEK removes the endothelial cells from the patient and replaces them with a donor graft consisting of a thin strip of stroma, Descemet membrane, and endothelial cells.[2] A DMEK is a similar process, except it does not include donor stromal tissue.[2] These are both standard of care now, with favor resting on the DMEK procedure due to faster recovery in visual quality.[3]

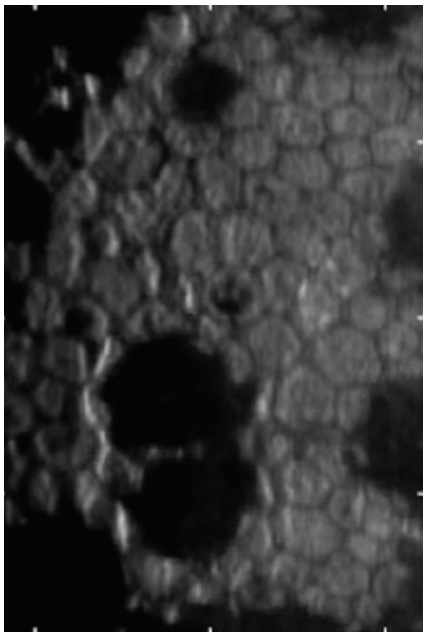

Figure 1. Early presentation of FCD based on endothelial cell count.

DSEKs are typically reserved for the more complex eyes in need of treatment for FCD.

Healing time for DMEK and DSEK is immensely better than that for a PKP, but they have their shortcomings as well. Following a successful placement of the donor tissue, a gas bubble is placed in the eye to help with adherence to the host cornea. Vision is obscured for about 1 week to allow time for the bubble to resolve. In addition to poor vision, the patient needs to lay on their back, as flat as possible, for 45 minutes out of every hour. This is done for 1 to 3 days, depending on surgeon preference, to position the bubble correctly. Beginning 1 week following surgery, there is also potential for re-bubbles if the graft does not successfully attach.

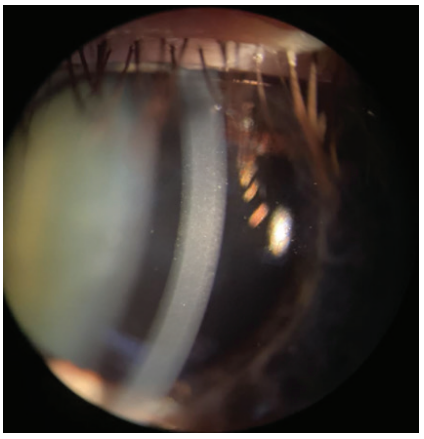

Figure 2. Slit-lamp image of mild/moderate FCD depicting stippling of the endothelium.

Now on the horizon is a new therapeutic surgical intervention known as Descemet stripping only (DSO), or Descemetorhexis without endothelial keratoplasty (DWEK), which removes endothelial cells from the patient without the addition of a graft or donor replacement. Below are two cases to demonstrate when these surgical interventions may be relevant.

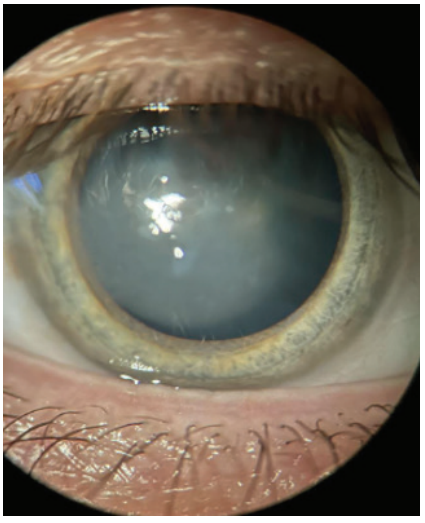

Figure 3. Central clouding present in the right eye.

AT A GLANCE

- Penetrating keratoplasty used to be the only treatment option for patients with late-stage Fuchs corneal dystrophy (FCD), but it is rarely performed now due to better options.
- The mainstay treatment for FCD is a Descemet membrane endothelial keratoplasty. It works by removing endothelial cells from the patient and replacing them with a donor graft consisting of Descemet membrane and endothelial cells.
- A new surgical intervention under study is Descemet stripping only, or Descemetorhexis without endothelial keratoplasty. It is a similar process without the addition of donor tissue once the endothelial cells are removed.

CASE NO. 1

A 52-year-old female presented to our clinic looking for a second opinion on options for improving her vision. She had been diagnosed with FCD a few years prior, and treatment had been delayed due to the COVID-19 pandemic. Her vision was always blurry and worse in the morning. She was using sodium chloride hypertonicity ophthalmic solution 5% (Muro 128, Bausch + Lomb) four times daily OU without relief. Her BCVA was 20/60 OD and 20/70 OS, and she reported feeling like her vision was impeding her ability to do her job as a teacher. She had 4+ guttae with central stromal edema about 4 mm round OD (Figure 3) and similar findings, along with a 2-mm round inferior central finding of bullous keratopathy OS (Figure 4). The thickest pachymetry reading from her corneal tomography scan was 1039 µm OS, which is double the average central corneal thickness

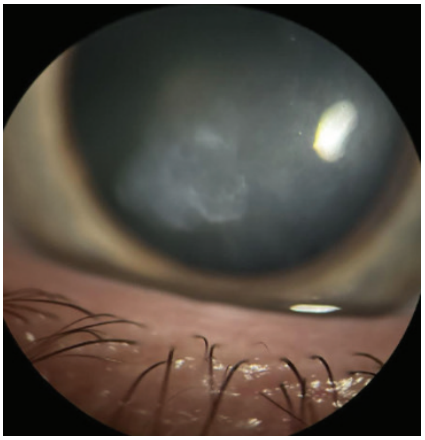

Figure 4. Bullous keratopathy present on the inferior central portion of the patient's left eye.

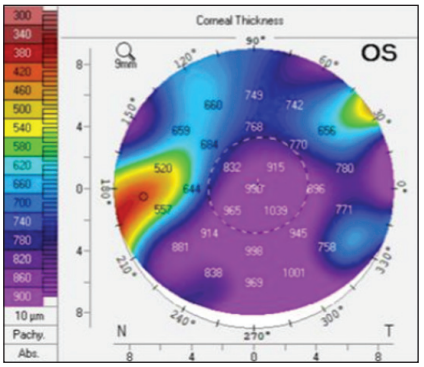

Figure 5. Pachymetry reading from a corneal tomography scan of the patient's left eye.

(Figure 5). Both eyes had significant 2+ nuclear sclerosis.

Treatment

The best course of treatment for this patient was to move forward with a staged procedure of DMEK OU in conjunction with a superficial keratectomy (SK) to give her eyes time to heal and stabilize for accurate measurements prior to cataract surgery. The patient's BCVA following partial corneal transplant and SK improved to 20/30 OU, and she is now awaiting cataract surgery.

Discussion

This case highlights exactly the outcome we hope to achieve in patients with severely compromised corneas. A few downfalls to keep in mind, however, are the length of time this patient went without intervention and her recovery time. Both eyes required surgery, 72 hours after which she was restricted to laying on her back to position the bubble appropriately. Surgery and recovery time can amount to 4 days off from work—sometimes longer—for each eye, which can be a deterrent to some patients, especially those still in the workforce. Care should ideally have been provided much sooner, before the patient's FCD progressed to this level.

Graft longevity is another important consideration. Patients are kept on a long steroid taper following surgery for the course of a year to help prevent graft rejection and/or failure. If they are at high risk for either, they may need to continue taking the steroid indefinitely. The long-term survival rate is not exactly known at this time, but studies have shown that at 5 years, there was a 96% chance of graft survival for DSEKs and DMEKs.[4] If the graft were to fail, the patient would have to undergo a graft exchange.

Author's note: At Vance Thompson Vision, we are investigating the effects of the rho-kinase inhibitor ripasudil hydrochloride hydrate (Glanatec ophthalmic solution 0.4%, Kowa Company) with DSO only or DSO only with simultaneous cataract surgery in patients with FCD. It is a double-masked, randomized study with the study drug versus placebo. The drop is instilled in the study eye four times daily for 12 weeks to help promote corneal recovery. To date, we have 10 patients in the study with one upcoming screening. Before this study, we participated in phase 1 and phase 2 of another corneal study evaluating the safety and efficacy of an intracamerally delivered drug on the regeneration of corneal endothelial cells. Six patients were enrolled in that study. These opportunities are a step in the right direction to hopefully remove the need for donor tissue in the future.

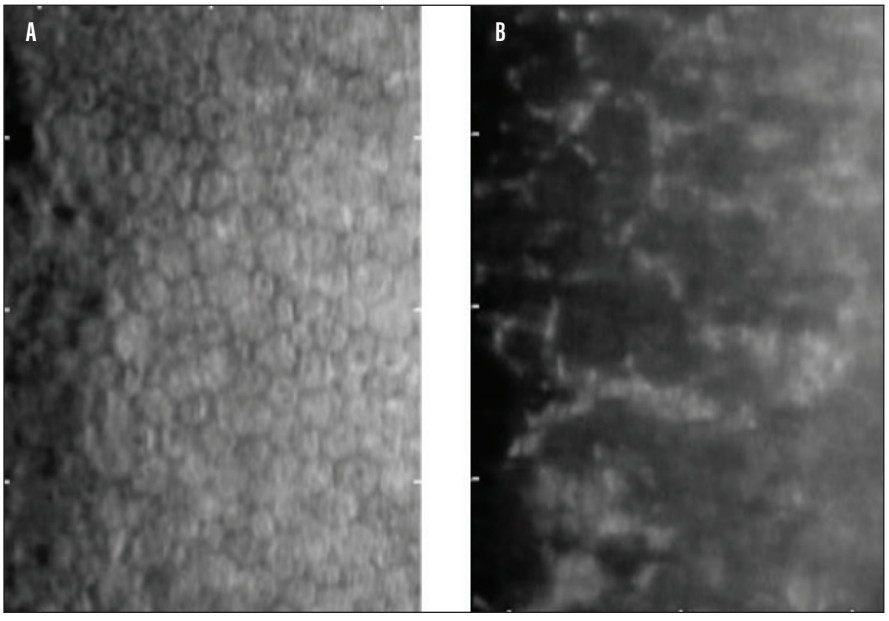

Figure 6. Normal endothelial cell count (A) compared with the patient's endothelial cell count (B), which shows diffuse loss of endothelial cell structure.

CASE NO. 2

A 53-year-old male presented to our clinic with complaints of night blindness, the glare being very

bothersome. He was having a hard time distinguishing faces and details when lighting was too bright, and his depth perception was worsening. His BCVA was 20/20 OD and 20/40 OS, glared to 20/60 OD and 20/250 OS. His ocular findings were normal for his age, aside from having 4+ central guttae OU (Figure 6).

Treatment Course

Options of monitoring versus DMEK only versus DSO only were discussed with the patient, along with the risks and benefits of each. The option of monitoring was presented to establish the patient's motivation to move forward with any surgical intervention. He did not have any significant stromal swelling or bullae. Pain was not the issue; what bothered him was visual quality. DMEK and DSO were both presented as options, with the potential to solve his vision quality concerns, but some patients prefer to move forward with FDA-approved procedures.

To minimize interference with daily life following surgery, he chose to move forward with the clinical trial. In doing so, he avoided graft rejection and/or failure, long-term topical therapy, and limited mobility immediately following surgery.

THE OPTIONS ARE IMPROVING

It is exhilarating to present multiple options to patients when previously we had only one to offer. Due to active enrollment, I am not at liberty to discuss clinical outcomes. However, studies such as the one previously discussed give us hope to one day stimulate the patient's own endothelial cells through topical agents and/or injections following DSO or DWEK to repair their visual quality and function. This would eliminate future risk of rejection and stringent restrictions following surgery, holding potential for a smooth transition from visual compromise to visual success. ■

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