DSEK VERSUS DMEK FOR ENDOTHELIAL DYSFUNCTION

A clinical comparison of two lamellar keratoplasty techniques.

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Endothelial dysfunction from Fuchs dystrophy or, less commonly, pseudophakic bullous keratopathy and other etiologies causes patients to experience blurry, hazy vision, glare and halos, and eventually pain due to rupturing bullae. As endothelial pump cells become fewer and weaker, progressive corneal edema causes an increase in corneal thickness and a decrease in visual acuity (Figure 1). Corneal transplantation is the only long-term option to restore corneal transparency and reverse corneal edema.¹

Lamellar endothelial keratoplasty has become the mainstream treatment for endothelial disease necessitating surgical intervention. Two major endothelial keratoplasty techniques are performed: Descemet stripping endothelial keratoplasty (DSEK) and Descemet membrane endothelial keratoplasty (DMEK). The merits of each are worth reviewing.

TWO TECHNIQUES

DSEK has been around for slightly longer than DMEK. Although the surgical techniques are similar, DMEK is slightly more challenging, and few surgeons have adopted this procedure. DSEK involves stripping and removing the Descemet membrane and endothelial layer from the patient’s cornea, followed by insertion of posterior stroma, Descemet membrane, and endothelium from donor tissue. In DMEK, Descemet and endothelium are removed, followed by insertion of only Descemet membrane and endothelium.

DSEK routinely leaves the corneal thickness at 600 µm or greater. DMEK, by contrast, keeps the anatomic integrity of the recipient’s cornea in place, and it commonly results in pachymetry of approximately 545 to 550 µm (Figure 2). Both techniques involve use of a gas or air bubble to tamponade the new corneal tissue into place.

DIFFERENCES IN OUTCOMES

Visual acuity results

A comparison of best-corrected visual acuity (BCVA) results in DSEK versus DMEK is one-sided in favor of DMEK. Tourtas et al compared BCVA in DMEK and DSEK patients preoperatively and postoperatively at 3 and 6 months.² In both surgical arms, BCVA improved by more than four Snellen lines at 6 months postoperative. At 3 months postoperative, mean logMAR acuity in DMEK patients was 0.21 (20/32) and in DSEK patients was 0.48 (20/60). At 6 months postoperative, mean logMAR acuity in DMEK was 0.17 (20/30+) and in DSEK was 0.36 (20/40-).

It is our belief that this study sells both DMEK and DSEK short on postoperative BCVA in comparison to what we have observed clinically. However, the finding that DMEK achieved better BCVA than DSEK was correct. This study also showed that visual acuity recovery was quicker after DMEK than DSEK, a finding that is supported by numerous other studies.

In a larger study, Hamzaoglu and colleagues compared postoperative BCVA in 100 DMEK patients and 100 DSEK patients.³ At 6 months postoperative, mean BCVA was 20/26...
in the DMEK patients and 20/32 in the DSEK patients. What is more impressive, at 6 months 46% of DMEK eyes achieved 20/20 or better BCVA, compared with 13% of DSEK eyes.

Long-term Graft Success
Comparing long-term graft success in DMEK versus DSEK, two variables come into play. Endothelial cell density (ECD) and risk of transplant rejection both affect long-term transparency. In the paper of Tourtas et al, the difference in mean ECD between the two procedures was not statistically significant at 6 months postoperative. Preoperatively, ECD in the donor grafts was approximately 2,500 cells/mm\(^2\) for both procedures, and at 6 months postoperative the ECD was near 1,500 cells/mm\(^2\) for both DSEK and DMEK.

Anshu et al compared the risk of graft rejection in DSEK and DMEK. They retrospectively compared rejection risk at year 1 or 2 postoperative in 140 DMEK eyes and 598 DSEK eyes. In the DMEK group, one of 140 eyes had a rejection episode (0.7% rejection rate), compared with 54 rejection episodes in 598 DSEK eyes (9% rejection rate) at 2 years. This parallels data published by Cursiefen et al, which found no rejection episodes in more than 100 DMEK transplants at 9 months.

Complications
The final variable to compare between DMEK and DSEK is the complication rates. The major complication of endothelial keratoplasty is graft adhesion, or the re-bubble rate. Tourtas et al found that 80% of DMEK patients needed a second air or gas bubble compared with only 20% of DSEK patients. In our clinical experience, re-bubble rates are overestimated for both groups, but DMEK definitely involves more graft detachments than DSEK. Recent research studies have shown that using a bubble of sulfur hexafluoride (SF\(_6\)) gas instead of an air bubble decreases detachment rates. Terry et al reported a re-bubble rate of 6% using SF\(_6\) bubbles in 80 patients.

Endothelial keratoplasty techniques have revolutionized the surgical options and outcomes for patients with Fuchs dystrophy or pseudophakic bullous keratopathy. Both DMEK and DSEK offer benefits over traditional full-thickness corneal transplants. A strong case can be made for DMEK over DSEK as a first choice endothelial graft technique for a patient who has no history of incisional glaucoma surgery. DMEK has the anatomic advantage of maintaining a natural total corneal thickness similar to presurgical pachymetry (to watch, visit eyetube.net/?v=ihoho). Thicker pachymetry, coupled with possible increased higher-order aberrations and posterior astigmatism, limits DSEK patients’ potential BCVA.

Equivalence of ECD results, coupled with a lower risk of graft rejection, also favors DMEK. Re-bubble rates are definitely higher in DMEK, but a graft re-bubble, if done correctly, will not affect the final acuity outcome or ECD.

Given these facts, why does DMEK represent less than 15% of endothelial keratoplasty procedures being performed? The majority of DMEK grafts are prepared by the eye bank, not the surgeon, so two major concerns remain: the difficulty and learning curve of DMEK surgery and the re-bubble rate. As more technique and technological advances are being reported for the surgical aspects of DMEK, more corneal surgeons seem willing to brave the learning curve. The addition of SF\(_6\) gas has definitely decreased re-bubble rates. With no harm to postoperative vision or graft health, patient inconvenience remains the biggest hurdle on re-bubble rates. When discussing options with patients, one can confidently say that DMEK offers faster visual recovery and the potential for better endpoint visual acuity.