CHAPTER 5

Penetrating and Posterior Lamellar Keratoplasty

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After the introduction of the operating microscope and 10-0 nylon suture more than 40 years ago, corneal transplantation surgery has undergone only minor refinements in technique and technology until recently. Now both full penetrating and posterior lamellar corneal transplantation are undergoing a new generation of technological developments, with the goals of both faster and better recovery of vision. Anterior segment optical coherence tomography (OCT) has been an important tool in developing and refining these procedures as well as managing patients preoperatively and postoperatively.

In 1999, Gerrit Melles, MD, PhD, introduced the potential for treating cases of endothelial inadequacy by transplantation of a layer of posterior stroma, Descemet's membrane, and endothelium. An equivalent layer of cornea in the recipient was removed. The procedure was termed *deep lamellar endothelial keratoplasty* (DLEK). Mark Terry, MD, varied the approach to the deep lamellar tissue removal and instituted a program of research and training of DLEK in the United States. Melles subsequently evolved the technique to removing only Descemet's membrane from the donor with a stripping maneuver. The donor posterior layer is floated up against the exposed underside of the recipient cornea. This procedure is usually termed *Descemet stripping endothelial keratoplasty* (DSEK) or, in recognition of the step of using an automated microkeratome to prepare the donor posterior layer, *Descemet stripping automated endothelial keratoplasty* (DSAEK). Using OCT technology, Figure 5-1 illustrates the creation of the donor flap and measurement of the result. Figure 5-1A shows the mounted donor corneoscleral button with dimensions measured, Figure 5-1B indicates with arrows the lamellar plane created by the microkeratome, and the flap tool in Figure 5-1C measures the anterior and posterior thickness achieved. OCT corneal imaging may have a place in the pre-cut and post-cut analysis of the donor cornea dimensions and conformation as more eye banks cut and prepare DSEK buttons for the surgeon's use.

In all of these procedures, two principle issues remain as surgical and postoperative challenges. The first is the adherence of the donor to the underside of the recipient cornea. Sutures are undesirable because of the distortion of the tissue that frequently results. An air bubble is typically the preferred method to establish connection of the donor to the host long enough for the endothelial pump function of the donor to create negative swelling pressure that will maintain adherence. Postoperative dislocation of the donor is a common problem, however, with rates reported between a low of 1% to 3% and a high of 20%.

The second challenge in DLEK and DSEK is optical. A theoretical advantage of deep lamellar endothelial transplantation is the avoidance of a 360-degree incision and suture, typically accompanied by distortions that stabilize slowly and often impair the quality of vision due to high levels of astigmatism and high-order aberrations. The speed of return of best-corrected visual acuity can take months in DSEK and DLEK, however. Moreover, most patients do not attain full recovery of their potential vision. As shown below, OCT documents that the donor tissue often