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Descemet membrane endothelial keratoplasty: graft rejection, failure and survival

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CHAPTER 9

Clinical Feasibility of Using Multiple Grafts from a Single Donor for Quarter-DMEK

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LETTER TO THE EDITOR

Editor, Descemet membrane endothelial keratoplasty (DMEK) may have opened the door towards more efficient use of donor corneal tissue (Lie et al. 2010; Tenkman et al. 2014). Recently, we have introduced Quarter-DMEK for the treatment of Fuchs endothelial corneal dystrophy, which could potentially quadruple the yield of endothelial transplants from the same donor pool (Müller et al. 2017). To deliver on this promise, it would be important to evaluate whether multiple Quarter-DMEK surgeries are feasible in a clinical and eye bank setting, as it may require adapted logistics to distribute eight grafts from one donor within a short time window.

As a first approach, we transplanted Quarter-DMEK grafts in pairs, that is two grafts from each eye of a single 74-year-old male donor (Figure 1), all of which were prepared by the same eye bank technician (JTL), processed in identical fashion at Amnitrans EyeBank Rotterdam and transplanted into four eyes of four patients (mean age 71 ($\pm$ 8) years; Figure 1) on the same day by the same surgeon (LB). Quarter-DMEK graft preparation and surgeries were uneventful, except for Case 1 in which the graft inadvertently was partially flushed out and therefore reinserted. At six months postoperative, all eyes reached a best corrected visual acuity (BCVA) of ≥ 0.6 (20/30) and three reached ≥ 0.8 (20/25). For Cases 1 and 2 (grafts obtained from the right donor eye), endothelial cell density decreased by 80% and 79% at six months, and for Cases 3 and 4 (grafts obtained from the left donor eye), 54% and 66%. Both grafts from the right donor eye showed postoperative graft detachment requiring rebubbling.

Our study may be informative in two ways: first, the concept of using multiple endothelial grafts from the same donor cornea proved feasible in a clinical setting. All four eyes obtained an acceptable BCVA and the initial endothelial cell density decrease may be higher than after conventional DMEK, presumably owing to early endothelial cell redistribution over bare areas (Baydoun et al. 2012; Gerber-Hollbach et al. 2016). Second, donor tissue viability may differ between globes obtained from the same donor, even if all tissues were processed in identical manner.

For Quarter-DMEK to get widely adopted, it should not only be clinically successful, but also logistically feasible. Processing eight grafts from a single donor might introduce new challenges, because multiple recipient eyes need to be

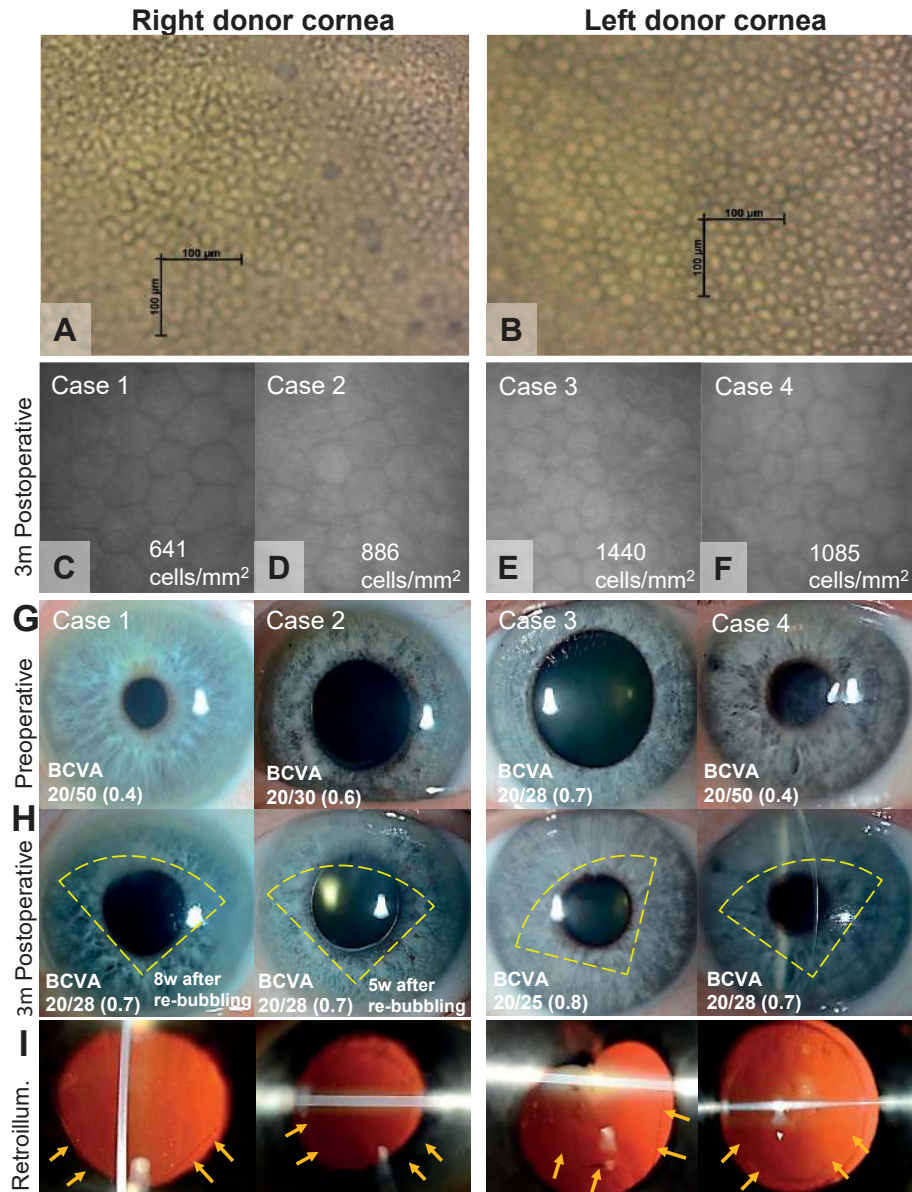


Figure 1. In vitro light microscopy images of the right (A) and left (B) donor cornea procured from the same 74-year-old, male donor, and in vivo specular microscopy images (C-F) at 3 months postoperatively of the four recipient eyes that received Quarter-DMEK grafts from the right donor cornea (C and D) and the left donor cornea (E and F). Endothelial cell density (ECD) at this time-point was 641 cells/mm² (Case 1), 886 cells/mm² (Case 2), 1440 cells/mm² (Case 3) and 1085 cells/mm² (Case 4). Slit lamp images of the four Quarter-DMEK eyes preoperatively (G), and 3 months postoperatively (H). The orientation of the Quarter-DMEK grafts is outlined by the yellow dashed lines in the slit lamp (H) and the orange arrows in the retro-illumination images (I). BCVA = best corrected visual acuity at each time-point; retroillum = retro-illumination.

accommodated within a short time window and tissue quality requirements may have to become stricter.

Furthermore, it would be interesting to see whether eye banks and surgeons would prefer transplantation of all grafts from the same donor (eye) in the same clinic. On the one hand, eye banks would then require only one shipment while surgeons may benefit from multiple grafts with similar 'behaviour', enabling some anticipation on surgery and aftercare. However, paired graft dysfunction may occur, potentially resulting in multiple graft-related complications in case of poor tissue viability.

The concept of transplanting multiple grafts from the same donor cornea may require more critical logistics for eye banks/surgeons. In addition, it may allow for unique inner-donor-eye transplant validation to improve surgical outcomes and/or reduce complications by grafting, for example Quarter-DMEK in two phases: if transplantation of a first quadrant shows good graft viability, that is complete attachment and corneal deturgescence, then as a second step, the other quadrants could be released for transplantation.

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