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COMMENT

Endothelial keratoplasty: is Descemet membrane endothelial keratoplasty the way forward? Yes

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Evolution and refinement of endothelial keratoplasty

It is widely accepted that endothelial keratoplasty is the preferable treatment for corneal endothelial disorders. Refinements in the last decade have enabled corneal surgeons to remove the diseased recipient Descemet membrane (DM) and endothelial layer with a descemetorhexis, and specifically replace these posterior layers by means of an endothelial keratoplasty (EK).[1,2] Transplanted grafts may include donor stroma of variable thickness, with a tendency towards thinner grafts, thus moving from Descemet stripping (automated) endothelial keratoplasty (DS(A)EK)[2,3] to ultrathin DS(A)EK (UT-DS(A)EK)[4] and finally to Descemet membrane endothelial keratoplasty (DMEK).[1] In DMEK, the transplant consists only of DM and endothelium. Lately, DMEK has been refined into a standardized 'no-touch' procedure, ready for the typical corneal surgeon in any clinical setting and at low cost.[5] Alternative or modified techniques have been also described and standardized in an attempt to make DMEK feasible and successful also in more demanding and complicated cases.[6–8]

Improving and accelerating visual rehabilitation

Following DS(A)EK, the average vision at 6 months is 20/40 (0.5), rarely reaching 20/25 (0.8) or better.[9] Irregularities in graft thickness and the stromal interface are believed to induce additional optical aberrations compromising the visual outcome.[10] Vision in eyes with irregularities in the DS(A)EK graft thickness or in the stromal interface was shown to improve markedly with a re-operation, replacing the DS(A)EK graft with a DMEK.[11] Ultra-thin DSAEK might provide better visual results than standard DSAEK,[4] but visual rehabilitation still seems to be slower than with DMEK. After DMEK, ≥80% of the eyes without other ocular comorbidities can reach a BCVA of ≥20/40 (0.5) already within the first month after surgery, increasing to ≥95% at 6 months. Moreover, at 6 months postoperatively, 80% of the eyes may achieve a BCVA ≥20/25 (0.8) and almost 50% may even reach 20/20 (1.0).[12,13] Visual rehabilitation is usually fast, with most patients reaching their final BCVA within 1–3 months.[14] This may prove extremely helpful in younger, more 'active' patients as well as in patients who are practically 'monoculus'. The proof of DMEK's superiority comes from the patients themselves, as in a series of patients with one eye operated with DSAEK and the fellow eye with DMEK, overwhelmingly, they prefer the vision in their DMEK eye.[15]

DS(A)EK induces a mean hyperopic shift of about +1.5 D[3,16] and UT-DSAEK of +0.7 D,[4] whereas DMEK presents a shift of only +0.4 D.[13] In fact, the small hyperopic shift observed after DMEK is actually a reversal of the corneal edema due to the preoperative endothelial insufficiency.[17] Refractive stability is achieved already within 3 months,[18] offering again an advantage over DS(A)EK.

The thickness of the DMEK graft is equal everywhere; therefore, the lenticule effect observed after DS(A)EK (where peripheral areas may be thicker than the center, thus inducing a hyperopic shift) is not observed after DMEK.[17] Moreover, a small decentration of the graft in DMEK does not compromise the visual outcome, whereas a decentered DS(A)EK graft may induce significant visual distortions.

Indications

Fuchs Endothelial Corneal Dystrophy (FECD) and Bullous Keratopathy (BK) are the most

common indications for EK. However, the characteristics of the DMEK graft described before, along with advanced modified techniques that have been described in the literature, make DMEK an ideal choice for younger phakic patients who do not want to abolish their accommodation privilege,[19] for patients with a shallow anterior chamber, and for patients with an anterior chamber IOL,[7] behind a failed Penetrating Keratoplasty (PK) or in the presence of glaucoma tube.[8]

Controlling complications

The incision required to insert a DMEK graft does not exceed 3 mm-width, which is significantly smaller compared to the one commonly required for a DS(A)EK graft and also does not require suturing. The absence of sutures and corneal surface incisions (like venting incisions) in DMEK not only preserves the refractive surface of the eye but also eliminates all suture-related complications.

Graft detachment is the most common complication following all forms of endothelial keratoplasty. With DS(A)EK, this may occur in 0–82% of surgeries.[20] Similarly, detachment rates of 20–60% have been reported after DMEK, although many of these cases do not appear to be clinically significant.[21,22] Frequently, DMEK detachments are small, peripheral, and temporary. And even when the detached areas are both large and central, some patients nevertheless achieve an acceptable BCVA of $\geq 20/40$. Clinically significant detachments, which are detachments over 1/3 of the graft surface, and/or affecting the visual axis, do not exceed 10-15%[23–25] of all DMEK surgeries. Technique standardization and surgical experience in DMEK seem to decrease the overall detachment rate to 10%, with only 4.8% being clinically significant.[25]

Reducing rejections and secondary glaucoma

Allograft rejection rate after DMEK is about 1%,[18,26] which is considerably lower than any other keratoplasty technique. The fact that a DMEK graft bears no stroma may make it less immunogenic as it presents fewer antigens to the recipient's immune system.[18]

An acute endothelial cell density decrease of about 34% is observed in the first 6 months after DMEK, followed by an average additional yearly decrease of about 8%, which is comparable to DS(A)EK. However, the diameter of DMEK grafts (8.5–11.0 mm) may exceed that of DS(A)EK (8.0–9.0), due to the different way of preparation (collecting the DMEK graft from the endothelial side of the donor cornea allows for a maximum diameter up to the trabecular meshwork); subsequently providing a larger pool of endothelial cells and potentially enhancing graft survival. Midterm and long-term graft survival after DMEK proves to be similar or superior to other keratoplasty techniques for the same indications.[27–29]

Due to the reduced rejection rate in DMEK, topical corticosteroids can be tapered down earlier in the postoperative period and the patients can be kept on relatively weaker topical corticosteroids, thereby reducing the potential risk for steroid-induced glaucoma.[30]

Saving money and tissue

DMEK turns out to be a technique much cheaper than any other corneal transplantation and definitely cheaper than DS(A)EK and UT-DS(A)EK because no microkeratome and no sutures are required. No additional equipment is required for preparing the graft, like any type of mechanical microkeratome (or femtosecond laser) required for DSAEK and UT-DSAEK. The equipment also used for the operation itself is relatively inexpensive and definitely cheaper than a DS(A)EK or a PK, making DMEK accessible even in countries with financial difficulties.

Moreover, suitable DMEK grafts may be collected from donor corneas not approved for a PK or a DS(A)EK, for example, due to a large arcus, stromal scars, insufficient scleral rim, and so on, thus, saving valuable tissue. Furthermore, with innovative techniques like the hemi-DMEK,[31] tissue may be utilized in an even more efficient way.

Conclusion

Conclusively, DMEK is a standardized, minimally invasive, sutureless endothelial keratoplasty technique, offering fast and optimal visual rehabilitation with minimum complications and unremarkable rejections at low cost and with an increasing success rate even in demanding cases. Subsequently, DMEK rises as the golden standard in endothelial keratoplasty.

Conflict of interest

Dr Liarakos receives honorary fees from Alcon. Dr Melles is a consultant for DORC and SurgiCube International. The remaining authors declare no conflict of interest.

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