Two cases of ultrathin Descemet stripping automated endothelial keratoplasty utilizing a graft that had undergone radial keratotomy

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This is a report of two cases in which tissue that had undergone radial keratotomy (RK) was utilized for double-pass ultrathin Descemet stripping automated endothelial keratoplasty (UT-DSAEK). Postoperative slit-lamp examination, visual acuity, anterior segment optical coherence tomography, and specular microscopy were available 30 months after surgery. Both corneas from a donor, who had undergone RK several years before his demise, and were otherwise suitable for endothelial keratoplasty were prepared for UT-DSAEK using double-pass dissection using first a 300 µm microkeratome head and then a 130 µm microkeratome head (ALTK system, Moria, Antony, France). After the second cut, the tissue was punched to 9.0 mm and transplanted in two eyes with endothelial decompensation according to standard technique. As early as 3 months after surgery, both patients had 20/25 best-corrected visual acuity, which remained stable for the following 27 months. Postoperative endothelial cell loss was 34% and 57% at 2.5 years. In conclusion, post-RK donor tissue can be used for UT-DSAEK.

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Radial keratotomy (RK) was the first incisional corneal refractive procedure to become widely popular. It is estimated that approximately 1.2 million patients underwent RK in the United States between 1980 and 1990 and it is therefore conceivable that more and more donors may have undergone this procedure.[1,2] Current criteria of Eye Bank Association of America's Medical Advisory Board state that while prior RK is a contraindication for the use of graft in penetrating keratoplasty, a cornea with a noninfectious anterior pathology that does not affect the posterior stroma, and endothelium is acceptable for endothelial keratoplasty procedures.[3] However, the use of post-RK grafts for endothelial keratoplasty remains controversial.[4,5] In this paper, we report two cases in which post-RK grafts were used in two eyes undergoing ultrathin Descemet stripping automated endothelial keratoplasty (UT-DSAEK).

Case Reports

Donor tissue was obtained from a 58-year-old donor male deceased after sudden cardiac arrest, who underwent RK many years before his demise. No further details were available in regard to the RK surgery. Endothelial cell counts were 2600 and 2700 cells/mm^2 with normal morphology. Mid-peripheral RK scars were seen in light microscopy. After consulting the surgeon, the corneas were preserved in organ culture medium and were provided to our institution for the use into be used for endothelial keratoplasty.

Ultrathin posterior lamellar grafts were produced using standard method published before.[6] Briefly, the donor cornea was mounted on an artificial anterior chamber of the ALTK system (Moria, Antony, France). The central corneal thickness of the donor was measured using ultrasound pachymetry (SP-3000; Tomey GmbH) to be 733 µm in the first cornea and 743 µm in the second cornea. A first cut was performed using a 300 µm microkeratome head. After the first cut, the central

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corneal thickness was measured again (325 μm in the first case and 317 μm in the second one). At this stage, the RK incisions could still be seen in both corneas. After turning by 180°, the dovetail of the artificial anterior chamber, a second cut was performed in both corneas using a 130 μm microkeratome head. At this point, faint radial marks could still be seen in the periphery of both corneal lamellae, as could be better visible after trypan blue stain. Videos 1 and 2 illustrate the tissue preparation in the described cases.

As a large optical zone of at least 6.5 mm was found to be free from any scarring in both cases, the tissue was further prepared and transplanted as per standard technique.[6] Surgery and the postoperative course were uneventful in both cases.

The first recipient was a 40 year old with a failed penetrating keratoplasty (PK) graft. At the last follow-up visit (2.5 years postoperatively), visual acuity was 20/25 with a spectacle correction of +2.5 sphere −4.5 cylinder at 50°. Endothelial cell density was 1715 cells/mm^2 (i.e., a loss rate of 34%). The cornea and graft-recipient interface appeared clear. Anterior segment optical coherence tomography (AS-OCT) demonstrated a graft of regular shape with a central thickness of 88 μm, and a thickness of 90 μm, 91 μm, 93 μm and 90 μm, 1500 μm temporally, nasally inferiorly and superiorly from the center.

The second recipient was a 62-year-old female with Fuchs' dystrophy and cataract. She underwent UT-DSAEK combined with phacoemulsification and PCIOL insertion. At the last follow-up examination (also 2.5 years postoperatively), visual acuity was 20/25 with a spectacle correction of +2 sphere −1.75 cylinder at 30°. Endothelial cell density was 1170 cells/mm^2 (i.e., a loss rate of 57%). The cornea and graft-recipient interface appeared clear. AS-OCT showed a regularly shaped graft with a central thickness of 87 μm, and a thickness of 82 μm temporally, 110 μm nasally, 119 μm inferiorly, and 112 μm, 1500 μm superiorly from the center.

Discussion

Phillips *et al*. have reported the use of two post-RK grafts for DSAEK as a part of a case series of DSAEK utilizing corneas with various anterior stromal pathologies. Their results compared well with a control group of matched regular donors.[4] In a reply to this work, Khalifa *et al*. prepared two post-RK grafts using a 350 μm head obtaining residual stromal bed of 120 and 132 μm. In this report, radial endothelial scars were found underlying radial stromal incisions and scanning electron microscopy demonstrated epithelial cell presence in the stromal interface of the RK incisions in both grafts.[5] In our cases, incision lines could still be seen after the second cut, but they could not be identified postoperatively, and we doubt whether they had any effect on the patient's quality of vision. While we had no means of excluding the presence of epithelial cells in the implanted graft, it has been reported before that epithelial cells may be implanted into up to a third of venting incisions commonly performed for the evacuation of interface fluid in DSAEK.[7] However, the proliferation of this cell to produce frank epithelial downgrowth remains questionable.[8,9] Theoretically, as corneal radial incisions are at risk for traumatic dehiscence even years after surgery,[10] post-RK donor tissue may split apart under the high pressure induced by microkeratome-assisted dissection and/or get entangled inside the microkeratome head. In addition, the blade might be driven into a false route by one of the radial incisions, thus creating a different and deeper plane of dissection. This possible type of complications did not occur in any of our two cases.

Descemet's membrane endothelial keratoplasty (DMEK) and Pre-Descemet's endothelial keratoplasty (PDEK) are techniques in which the stroma is not used for transplantation. As the post-RK grafts have sustained the pressure of the microkeratome-assisted dissection, we believe that they would also sustain the mechanical stress caused by peeling Descemet's membrane in DMEK, and the pneumatic dissection done in PDEK. In the latter technique, the radial incisions can theoretically enable air to escape superficially during the dissection, making the procedure more challenging. Post-RK grafts prepared using these techniques will probably be no different from usual grafts in terms of the optical quality of the interface and the risk of epithelial ingrowth.

Conclusion

After preparation for UT-DSAEK, tissue with preexisting post-RK incisions has a scar-free optical zone large enough to be used for transplantation. The use of double-pass UT-DSAEK technique enables the removal of all but the very deep stroma adjacent Descemet's membrane, thus minimizing the possibility of leaving in place clinically significant residual RK scars at the edge of the optical zone. Recently, introduced microkeratome systems for the dissection of single-cut ultrathin grafts, as well as techniques such as DMEK, and pre-Descemet's membrane endothelial keratoplasty (PDEK) may prove equally efficient for the dissection of tissue with anterior stromal scars.

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Conflicts of interest

There are no conflicts of interest.

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