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Case report

Descemet membrane endothelial keratoplasty for endothelial decompensation after previous radial keratotomy

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ABSTRACT

Purpose: To report Descemet membrane endothelial keratoplasty (DMEK) for endothelial decompensation in an eye with previous radial keratotomy.
Observations: A history of radial keratotomy may hasten endothelial dysfunction. Previously reported surgical treatments include penetrating kerotoplasty and Descemet stripping automated endothelial keratoplasty.
Conclusions and Importance: DMEK may be successfully used in post-RK eyes with good recovery of visual acuity and patient satisfaction.

1. Introduction

Radial keratotomy (RK), a refractive surgical procedure used to treat myopia by creating radial incisions to flatten the central cornea, has largely fallen out of favor due to the relative success of laser keratorefractive procedures. Several complications of RK have been described in the literature, including corneal perforation,[1] decentration,[2] over- or undercorrection,[1] irregular astigmatism, contact lens intolerance,[2] stromal melting, infection,[3] and endothelial cell loss.[4–6] There have been case reports of corneal transplantation performed for intolerable side effects from prior radial keratotomy, including penetrating keratoplasty (PKP)[7–9] and Descemet stripping automated endothelial keratoplasty (DSAEK)[10,11] after RK. There is one report[12] in the literature on managing patients with Fuchs' endothelial corneal dystrophy with loss of vision after radial keratotomy using either penetrating keratoplasty or DSAEK. In this report, we discuss relevant issues and potential therapeutic approaches for this unique patient population and propose that transplanting endothelial cells with DMEK may also be an effective option.

2. Case report

A 56-year-old female presented with a history of radial keratotomy performed approximately 25 years prior (sixteen combination radial keratotomy-astigmatic keratotomy cuts in each eye) for myopia and astigmatism correction. The surgery was uneventful and the patient experienced good vision for almost 20 years post-operatively before noting gradually decreasing vision in the left eye. On presentation to our department she complained of poor vision in the left eye for the past 5 years. The patient's best-corrected visual acuity (BCVA) in the affected eye was 20/400. Slit lamp examination was notable for RK scars, diffuse corneal guttae, and nuclear sclerotic cataracts in both eyes (Fig. 1). She reported no family history of corneal dystrophy. Initial corneal topography revealed 7.2 diopters of irregular against-the-rule corneal steepening at 178° in the left eye (Fig. 2) and optical pachymetry measured a central corneal thickness (CCT) of 571 μm. K values were 25.7/32.8 × 178. There were no signs of corneal ectasia.

The patient elected to proceed with cataract surgery alone for the left eye. The cataract was removed using phacoemulsification and a +19.5 diopter monofocal Tecnis ZCB00 intraocular lens (Johnson & Johnson Vision, Jacksonville, Florida, USA) was implanted without complications. One month post-operatively, her best visual acuity (BCVA) improved to 20/70, with manifest refraction of +2.50–3.00 × 110. She maintained this vision for approximately 4 months before re-presenting with UCVA 20/200. On examination her cornea was clouded; repeat optical pachymetry was unreliable given the degree of corneal edema. Although hypertonic ointment was prescribed, her vision continued to worsen and 15 months after cataract extraction, UCVA in the left eye deteriorated to CF at 3 feet with CCT of 733 μm.

A lengthy discussion of the risks and benefits of various corneal transplantation options were presented. Although PKP would address the RK scars as well as endothelial dysfunction, the recovery period could potentially be the longest among the corneal graft options. DSAEK would address endothelial dysfunction; however, irregular astigmatism from the RK scars would remain. Although not described in

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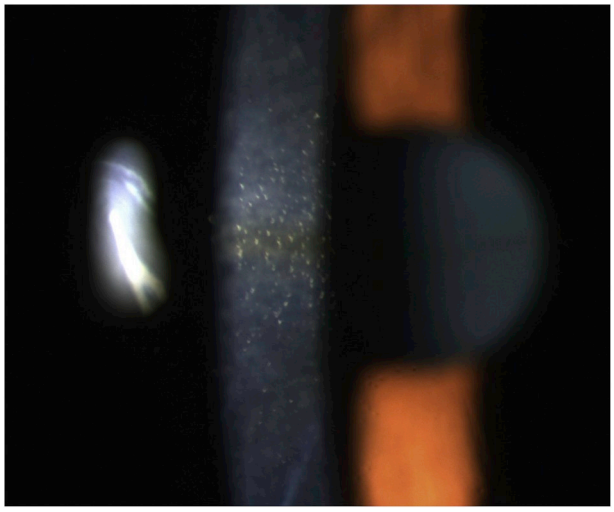

Fig. 1. Slit lamp photographs showing visually significant corneal guttata in our patient's left eye upon presentation.

the literature for this particular scenario, DMEK was presented as an alternative as it could potentially deliver better visual acuity than DSAEK.[13] The patient was most concerned with optimizing her post-transplant visual outcome, and thus elected to proceed with DMEK for the left eye with the goal of simultaneously treating her irregular astigmatism.

One month post-operatively, the patient's UCVA improved to 20/50. Slit lamp examination showed corneal transparency. Six months post-operatively, BCVA is 20/40 with manifest refraction of plano −4.00 × 90 and corneal topography with 4.0 diopters of against-the-rule astigmatism at 174.4° (Fig. 3). K values were 34.5/38.5 × 174.4.

3. Discussion

Comorbid corneal guttata in post-RK patients has previously been reported,[12] and it has been suggested that the combination of RK-associated endothelial trauma and age-related decline in endothelial cell density and function may cause the development of visually significant corneal edema in predisposed eyes.

There have been several case reports regarding surgical management of corneal decompensation after RK.[8–11] Kubaloglu et al. reviewed 24 eyes which underwent PK after RK for keratoconus and found post-operative BCVA to average 20/32, with a graft rejection rate of 25% (6 eyes).[8] Parmley et al. reviewed six cases of PK after RK: there were no intraoperative complications, and average post-operative BCVA was 20/30[9]. However, there are also reports of corneal incision dehiscence during PK.[10,11] More recently, DSAEK has been reported to treat endothelial complications after RK[12,14,15] with satisfactory visual outcomes: Moshirfar et al. report a mean post-transplant BCVA of 20/30[12], while Hayashi et al. reported a mean BCVA in logMAR of 0.45 ± 0.36

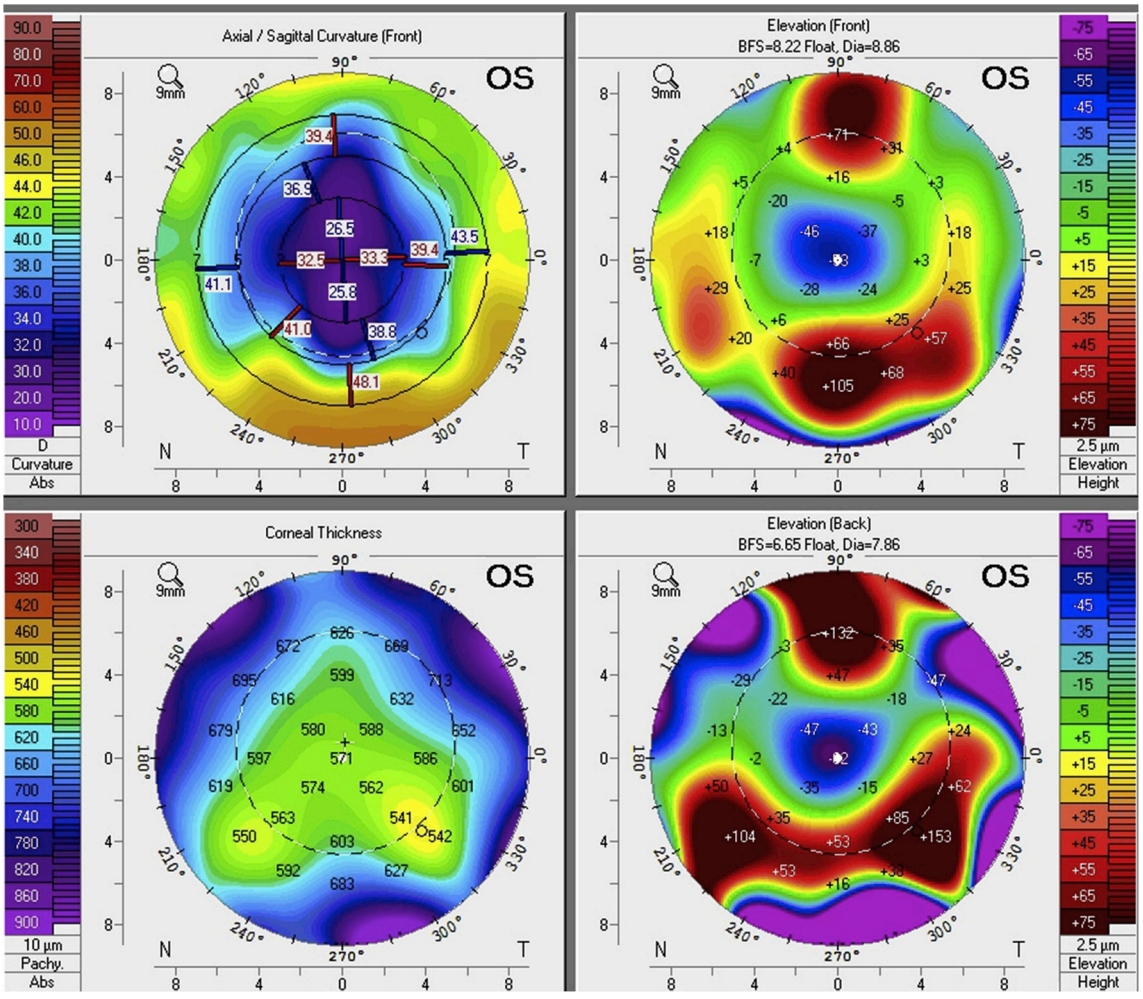

Fig. 2. Initial corneal topography measuring 7.2 diopters of irregular corneal steepening at 178° in the left eye.

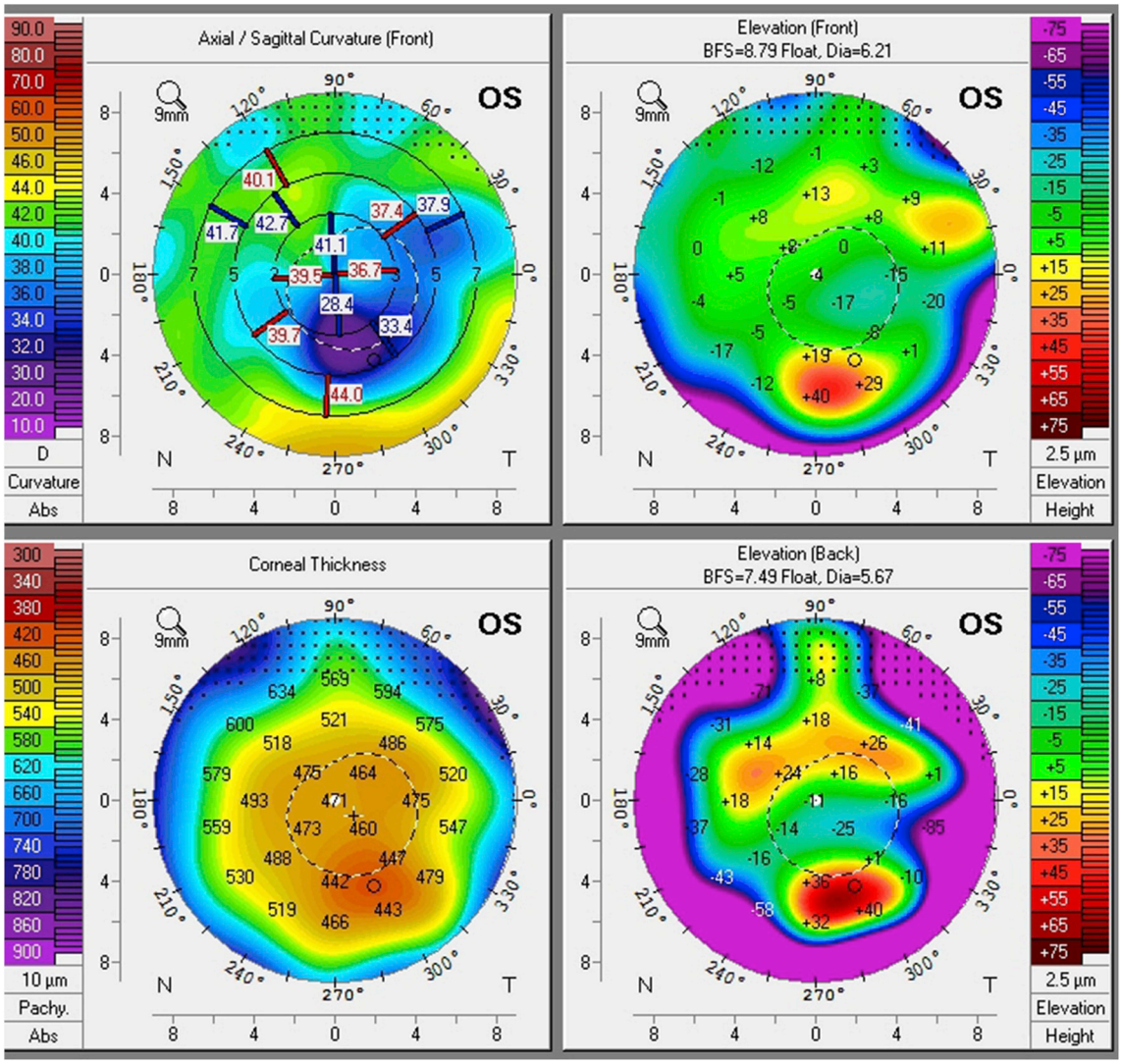

Fig. 3. Corneal topography six months after DMEK showing 4.0 diopters of against-the-rule astigmatism at 174° in the left eye.

and endothelial cell loss of 43.9%.[15] Nakatani and Murakami reported on 5 cases: there were no incidences of graft failure and 100% of patients had corneal transparency at one year of follow-up, with a mean endothelial cell loss in the donor graft of 68.2% and mean residual corneal astigmatism of 1.5 diopters.[14]

To our knowledge DMEK has never been reported in a post-RK eye for symptomatic endothelial cell dysfunction. Although Nakatani and Murakami suggest that DSAEK may be the procedure of choice for corneal failure after radial keratotomy,[14] we show here that DMEK may also be a viable option for endothelial recovery.

Another important consideration in managing post-RK patients is refractive error. Many of these patients go on to develop irregular astigmatism, often unpredictable hyperopic shift, and central corneal steepening, as was the case in our patient. Previous papers have shown that full-thickness corneal transplant can reduce astigmatism and corneal steepening.[8,9] Endothelial keratoplasty, whether conventional DSAEK or ultra-thin DSAEK, has been noted to induce hyperopic shift postoperatively-approximately +1.25 to +1.50 diopters.[16–18] Therefore, when planning a “triple-procedure” of DSAEK, cataract extraction, and intraocular lens implant, experienced surgeons have recommended selecting an IOL power aimed for −1.50 diopters to compensate for this resultant hyperopia.[18] However, DMEK has not been associated with such a hyperopic shift nor inducing additional irregular astigmatism.[13] Six months after DMEK, our patient's refraction went from hyperopia to plano and her irregular astigmatism reduced by 3 diopters. We did not expect DMEK to cause additional hyperopia or irregular astigmatism for this case, but were pleasantly surprised that both were reduced postoperatively. Although post-RK, endothelial decompensation patients remain a small cohort, more data would need to be collected to analyze whether there is a consistent trend toward refractive neutrality. Meanwhile, we suggest that DMEK is a viable option for post-RK patient who have endothelial decompensation from pseudophakic bullous keratopathy or Fuchs' corneal dystrophy.

Patient consent

The patient provided verbal consent for publication of this case report.

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The authors have no proprietary or commercial interest in any materials discussed in this article.

Conflicts of interest

No conflicting relationship exists for any author.
No competing interests among authors.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ajoc.2019.100503.

References

1. Jory WJ. Radial keratotomy: 500 consecutive cases. *Eye.* 1989;3:663–671.
2. Grimmett MR, Holland EJ. Complications of small clear-zone radial keratotomy. *Ophthalmology.* 1996;103(9):1348–1356.
3. Matoba AY, Torres J, Wilhelmus KR, Hamill B, Jones DB. Bacterial keratitis after radial keratotomy. *Ophthalmology.* 1989;96(8):1171–1175.
4. MacRae SM, Rich LF. Long-term effects of radial keratotomy on the corneal endothelium. *J Refract Surg.* 2011;14(1):49–52.
5. Tseng SH, Chen FK. Morphological and fluorophotometric analysis of the corneal endothelium after radial keratotomy. *Cornea.* 1998;17(5):471–475.
6. Chiba K, Oak SS, Tsubota K, Laing RA, Goldstein J, Hecht S. Morphometric analysis of corneal endothelium following radial keratotomy. *J. Cataract Refract. Surg.* 1987;13(3):263–267.
7. Raffaele N, Buschini E. Penetrating keratoplasty after radial keratotomy and recurrent immune overreaction. *Case Rep. Ophthalmol.* 2011;2(1):123–128.
8. Kubaloglu A, Koytak A, Sogutlu E, Kurnaz E, Ozerturk Y. Penetrating keratoplasty in keratonic eyes with prior radial keratotomy. *Eur J Ophthalmol.* 2010;20(1):35–40.
9. Parmley V, Ng J, Gee B, Rotkis W, Mader T. Penetrating keratoplasty after radial keratotomy. A report of six patients. *Ophthalmology.* 1995;102(6):947–950.
10. McNeill JI. Corneal incision dehiscence during penetrating keratoplasty nine years after radial keratotomy. *J. Cataract Refract. Surg.* 1993;19(4):542–543.
11. Robin JB, Beatty RF, Dunn S, et al. Mycobacterium chelonel keratitis after radial keratotomy. *Am J Ophthalmol.* 1986;102:72–79.
12. Moshirfar M, Ollerton A, Rodmerh TS, Hsu M. Radial keratotomy associated endothelial degeneration. *Clin Ophthalmol.* 2012;6:213–218.
13. Hamzaoglu EC, Straiko MD, Mayko ZM, et al. The first 100 eyes of standardized Descemet stripping automated endothelial keratoplasty versus standardized Descemet membrane endothelial keratoplasty. *Ophthalmology.* 2015;122(11):2193–2199.
14. Nakatani S, Murakami A. Descemet stripping automated endothelial keratoplasty for bullous keratopathy after anterior-posterior radial keratotomy. *Cornea.* 2013;32(9):1179–1182.
15. Hayashi T, Hirayama Y, Yamada N, Shimazaki-Den S, Shimazaki J. Descemet stripping automated endothelial keratoplasty for bullous keratopathy with an irregular posterior surface. *Cornea.* 2013;32(9):1183–1188.
16. Cheung AY, Chachare DY, Eslani M, et al. Tomographic changes in eyes with hyperopic shift after triple Descemet membrane endothelial keratoplasty. *J. Cataract Refract. Surg.* 2018;44(6):738–744.
17. Goldich Y, Artornsombidth P, Avni-Zauberman N, et al. Fellow eye comparison of corneal thickness and curvature in Descemet membrane endothelial keratoplasty and Descemet stripping automated endothelial keratoplasty. *Cornea.* 2014;33(6):547–550.
18. Holz HA, Meyer JJ, Espandar L, et al. Corneal profile analysis after Descemet stripping endothelial keratoplasty and its relationship to postoperative hyperopic shift. *J. Cataract Refract. Surg.* 2008;34(2):211–214.