

# Descemet membrane suturing to manage recurrent graft detachment in a patient with Descemet membrane endothelial keratoplasty on failed penetrating keratoplasty

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**Abstract:** A 65-year-old patient with history of keratoconus, mild cataract and penetrating keratoplasty over 30 years ago developed corneal oedema subsequent of graft failure with best corrected visual acuity (BCVA) of counting fingers. He underwent a successful cataract surgery combined with a 7.25 mm Descemet's Membrane Endothelial Keratoplasty (DMEK) with Sodium Hexafluoride (SF<sub>6</sub>) gas. His cornea remained oedematous inferiorly at 4 weeks, despite two subsequent re-bubbling due to persistent DMEK detachment inferiorly. This was managed by three radial full thickness 10-0 nylon sutures placed in the inferior cornea along with intracameral injection of air. Following this, his anterior segment ocular coherence tomography (OCT) confirmed complete attachment of the graft, and the sutures were removed 4 weeks later. Unaided visual acuity was 20/63 and BCVA was 20/32 after 8 months. DMEK suturing can be helpful in persistent DMEK detachments, which is refractory to repeated re-bubbling due to uneven posterior surface of previous PK.

**Keywords:** Descemet membrane, penetrating keratoplasty, suturing

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Penetrating keratoplasty (PK) has historically been the standard procedure for corneal transplant surgery, with the treatment for failed PK involving a repeat PK. However, over the last 15 years the option of endothelial keratoplasty (EK) on the failed PK has become a more favourable technique due to the reduced risk of graft rejection, fewer intraocular pressure rises, quicker recovery time, better visual acuity outcomes and prolonged graft survival.<sup>1</sup> Ang and colleagues<sup>1</sup> reported 5-year graft survival rate of 86.4% with DSAEK under failed PK compared to 51.3% with repeat PK. Nonetheless, the graft survival rate for EK in the setting of failed PK is not similar to that of the primary EK. EK under failed PK is associated with higher rate of re-bubbling, higher rate of endothelial cell loss and higher incidence of primary graft failure compared to primary EK.<sup>2</sup> While the 5-year survival rate of

primary EK is reported to be about 90%,<sup>3</sup> Einan-Lifshitz and colleagues<sup>4</sup> reported 53% survival rate with Descemets Membrane Endothelial Keratoplasty (DMEK) on failed PK among their patients. The main cause of failure in their patients was attributed to persistent graft detachment after one or more re-bubbling attempts. Re-bubbling deemed necessary in 43% of cases in Einan-Lifshitz and colleagues study where it was only successful in 25% of these cases. Similar results were found by Pierné and colleagues<sup>5</sup> where 50% of patients required re-bubbling within the first 3 weeks post-operatively.

We report a case with persistent graft detachment after cataract surgery combined with DMEK on fail PK which was refractory to re-bubbling attempts and was managed successfully by full thickness suturing.

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### Case report

A 65-year-old male patient with history of keratoconus and penetrating keratoplasty (PK) over 30 years ago developed corneal oedema subsequent to the graft failure in his left eye with best corrected visual acuity (BCVA) of counting fingers. He had an eccentric 7.5 mm penetrating keratoplasty, which made repeat full thickness keratoplasty with a larger donor graft a high risk for rejection. He also had a mild cataract. Therefore, he was offered Descemet membrane endothelial keratoplasty (DMEK) on failed PK combined with cataract surgery using standard keratometry of 43.5D and a hydrophobic acrylic intraocular lens. After inserting the intraocular lens, while the anterior chamber was filled with a cohesive viscoelastic device, we performed a Descematorhexis within the graft-host junction. Care was taken not to expose posterior stromal strands during Descematorhexis. After a thorough washout of the viscoelastic device a 7.25 mm Descemet membrane graft was delivered and secured on the stroma within the old penetrating keratoplasty, using an intracameral injection of 50% Sodium Hexafluoride (SF6) gas. Cyclopentolate 1% eye drops were used immediately after the injection of gas to prevent pupillary block, since he has had no peripheral iridotomies. The patient was advised to comply with supine posture for a minimum of 2 days and was given antibiotic-steroid combination drops qds for a month, G. Cyclopentolate 1% tds for a week and Tb. Acetazolamide 250 mg sustained release for 3 days post-surgery. One week post-operatively the cornea appeared oedematous with inferior detachment of DMEK graft (Figure 1(a)). Re-bubbling with air was performed at the slit lamp via 5 o'clock paracentesis,<sup>6</sup> the patient was started on Acetazolamide 250 mg slow release tablets for 3 days and advised to maintain a supine posture for a minimum of 2 days and ideally as long as the air was present in the anterior chamber. One week later, he was noticed to have persistent inferior graft detachment and corresponding corneal oedema (Figure 1(a)); therefore, the second re-bubbling was performed at the slit lamp in the same fashion. His cornea remained oedematous inferiorly at 4 weeks due to persistent inferior Descemet membrane detachment (Figure 1(a)) despite two subsequent re-bubbings. Careful inspection of his anterior segment OCT (AS-OCT) revealed a ridge on the posterior surface of the graft-host junction inferonasally (Figure 1(a)), which was the probable cause of his recurrent inferior Descemet membrane detachment. To manage this complication,

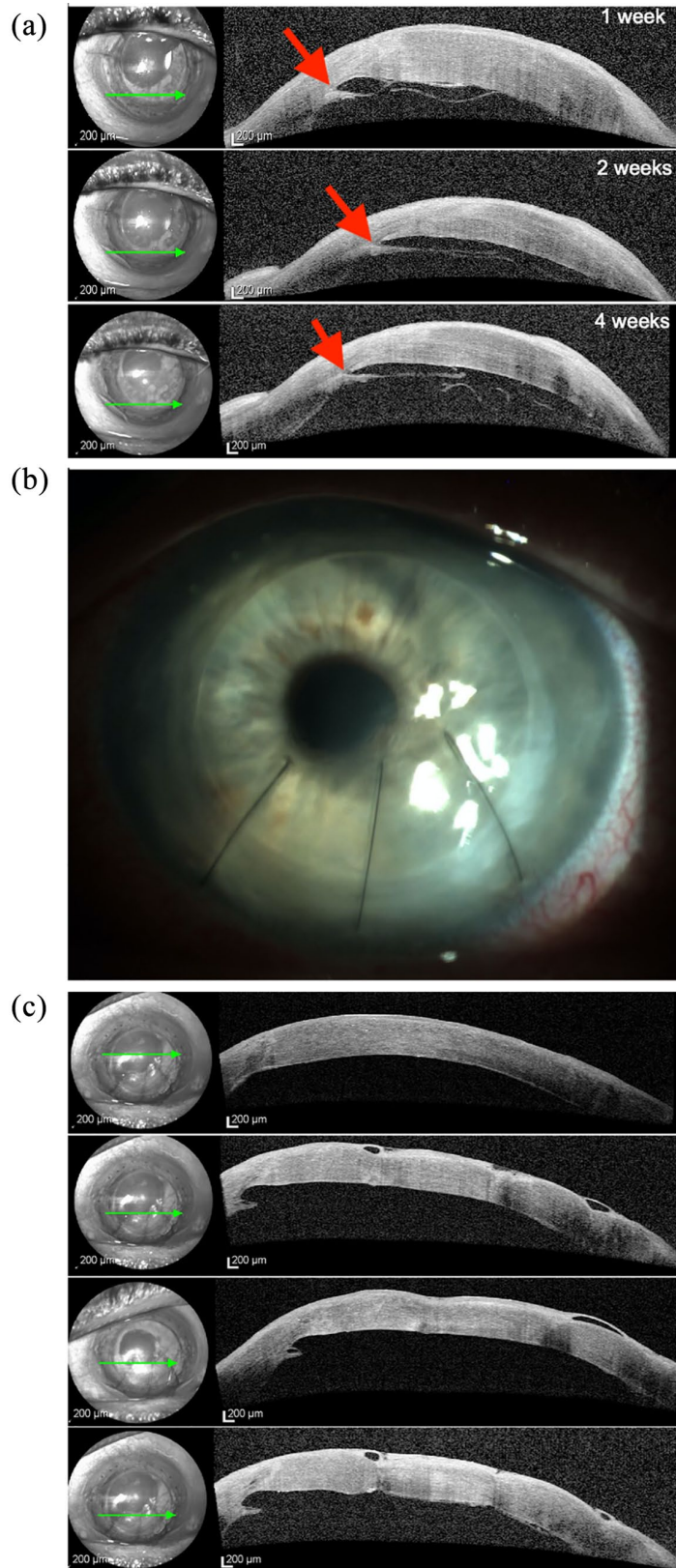
he underwent DMEK suturing in the theatre under subtenon anaesthesia. The detached graft was repositioned, using intracameral injection of air. Based on the extent of the DMEK detachment three radial full thickness 10-0 nylon interrupted sutures were placed in the inferior cornea to hold the graft in place. The needle passed through the host cornea and exited from the graft cornea. Care was taken not to tear the detached Descemet with unnecessary needle movement in the anterior chamber (Supplemental Video 1) (Figure 1(b)). One week post-operatively, his AS-OCT confirmed complete attachment of the DMEK graft with clear appearance of posterior protuberance (Figure 1(c)). Four weeks later, the corneal sutures were removed at the slit lamp and no further sutures were needed. Following this, his medications switched to G. Dexamethasone 0.1% qds for 2 months followed by bd for long-term. His corneal oedema resolved (Figure 2(a) and (b)) and his visual acuity gradually improved. Eight months from DMEK, his cornea was clear, and his unaided visual acuity was 20/63 with BCVA of 20/32 using rigid gas permeable contact lens (best spectacle corrected vision was 20/60 and best contact lens corrected vision was 20/32 before PK graft failure).

The patient provided written informed consent to publish all related medical data, images and videos.

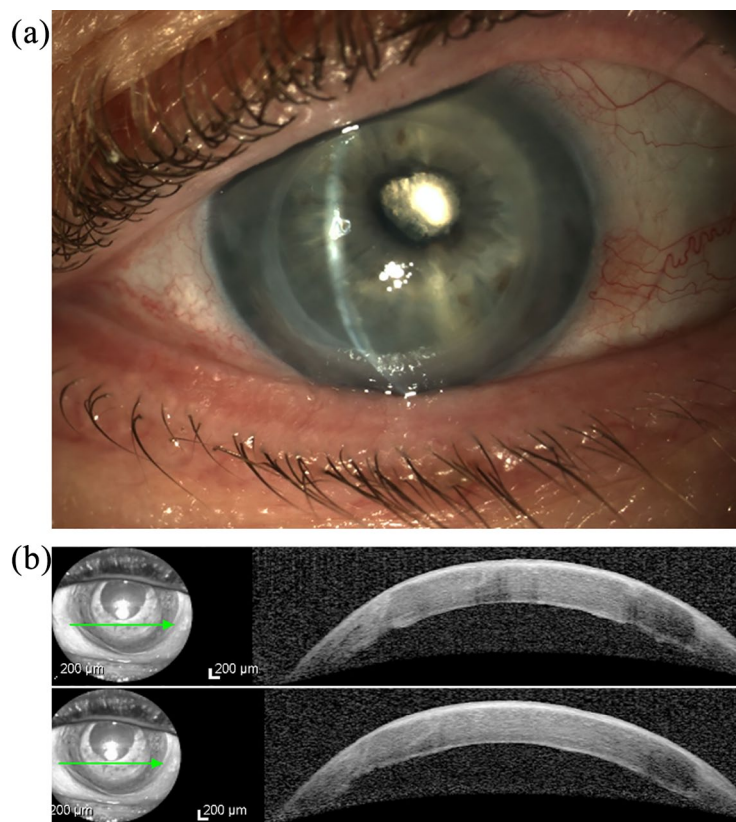
### Discussion

There are some reports in the literature describing suture placement techniques to improve graft adherence in Descemet stripping automated endothelial keratoplasty (DSAEK) on failed PK.<sup>7,8</sup> However, to our knowledge, our case is the first report of a patient with successfully sutured DMEK to a failed PK. Our technique involved placing three radial interrupted full thickness 10-0 nylon sutures into the inferior cornea along with an intracameral injection of air. The needle tip entered the anterior chamber through the host cornea and exited from the graft cornea without a pause once it touched the Descemet membrane. Apart from inadvertent Descemet tear, there is also risk of wrinkled graft and complete dislocation of Descemet membrane if there is too much manipulation of graft with the needle inside the anterior chamber.

Potential causes of an increased graft detachment rate in previously failed PK include irregularity of



**Figure 1.** (a) Anterior segment ocular coherence tomography (OCT) at 1, 2 and 4 weeks after initial phacoemulsification with intraocular lens implantation and Descemet's Membrane Endothelial Keratoplasty (DMEK). (b) 1 week post DMEK suturing. (c) Anterior segment OCT scans at various levels to show the DMEK attachment and posterior protuberance.



**Figure 2.** (a) Anterior segment photograph 8 months post-operatively. (b) Anterior segment OCT scans 8 months post-operatively.

the posterior corneal surface at the graft-host junction,<sup>9</sup> prior glaucoma shunt surgery,<sup>9</sup> and oversized DMEK graft.<sup>9</sup> A study by Pasari and colleagues indicated that re-bubbling was as high as 53% in an oversized graft, 27% in same sized and 33% in undersized grafts. The likelihood of re-bubbling was significantly higher with oversized grafts.<sup>9</sup> They suggested use of pre-operative AS-OCT to understand the extent and location of posterior corneal surface irregularity and guide the sizing and location of the graft.

In order to prevent recurrent Descemet detachment in eyes undergoing EK with high risk of graft detachment, some suturing techniques are described in the literature like safety-basket or cloverleaf retention suture.<sup>7,8</sup> They act like a scaffolding under the graft and provide extra support. However, these techniques are utilised in DSAEK but not DMEK. This is mainly due to delicacy of Descemet membrane. In order to reduce the risk of recurrent DMEK graft detachment in failed PK pre-operative AS-OCT from various angles can be employed to locate any posterior corneal

surface protuberance and guide on the location of the graft as of Pasari and colleagues.<sup>9</sup> Also, in cases with a large posterior protuberance a smaller DMEK graft that can attach entirely within the old PK margin may be preferable, although fewer endothelial cells are transplanted. Moreover, intraoperative AS-OCT has proved useful in primary DMEK. The same way, it can be employed to facilitate DMEK on failed PK and help to avoid the posterior surface irregularity. In the less likely event of recurrent DMEK detachment in spite of taking into account all mentioned precautions, then localised suturing would help resolve the situation as the final resort, as seen in our case.

Sorkin and colleagues<sup>10</sup> tried femtosecond laser and noticed significantly smaller rate of graft detachment in eyes with femtosecond laser assisted DMEK (F-DMEK) compared to manual DMEK (M-DMEK) (10% *versus* 65.5%) on failed PK. Complete removal of the host's Descemet membrane within the Descemetorhexis area with less remnant Descemet tags and islands,

a clean nontraumatic incision with no disturb to the Descemet which may lie peripheral to the Descematorhexis incision, and possible femtosecond-induced inflammation, which may promote tissue adherence are the potential reasons for a high rate of graft attachment in this group of patients.<sup>10</sup> Alió Del Barrio and colleagues<sup>11</sup> reported a series of 8 cases who underwent DMEK following a failed PK without host Descematorhexis. Only two patients in their series required re-bubbling, which represents a lower rate of re-bubbling compared to some studies. It is known that DM stripping manoeuvre could traumatise the stroma and dislodge some fibres, which consequently increase the risk of post-operative DMEK detachment. Therefore, they concluded DMEK on failed PK without Descematorhexis and removal of the host DM simplifies the surgery and reduces the rate of post-operative re-bubbling with equivalent level of efficacy.

In conclusion, we believe that special strategy should be adapted for DMEK in the setting of failed PK to reduce the risk of post-operative graft detachment. The suggested strategies include the following:

- Accurate pre-operative inspection of the AS-OCT to locate any irregularities on the posterior corneal surface.
- Descematorhexis size 0.25–0.5 mm smaller than the previous PK diameter.
- Smaller size DMEK graft in order to avoid the graft-host junction.
- Leaving the host's Descemet membrane with no Descematorhexis.
- Use of intra-operative OCT as a guide to avoid the posterior corneal surface protuberance.

While the majority of cases do not need this additional surgical step of suturing, our report demonstrates the potential efficacy of this technique in refractory cases. One of the limitations of this report is a relatively short-term follow-up and lack of data on the impact of suturing on endothelial cell density (ECD). It is known that each re-bubbling has a negative impact on ECD.<sup>12</sup> Therefore, it would have been difficult to estimate the effect of suturing independently on the ECD once the patient underwent two re-bubbling procedures prior to suturing. Further reports and studies with a larger sample size are required to fully assess the long-term safety and efficacy of this technique.

### Conflict of interest statement

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### Presentations

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### Supplemental material

Supplemental material for this article is available online.

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