

# Suture Pull-Through Technique for EndoArt Insertion in a Complex Case Scenario

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**Purpose:** The purpose of this study was to describe a novel suture pull-through technique of EndoArt implant insertion.

**Method:** EndoArt insertion was performed using a novel suture pull-through technique after several failed Descemet membrane endothelial keratoplasty surgeries for a 59-year-old woman who had undergone multiple surgeries after open globe injury and had artificial iris implant with scleral-fixated intraocular lens.

**Result:** With this technique, EndoArt insertion into the anterior chamber was possible without implant dislocation. Postoperatively, anterior segment optical coherence tomography was recorded and peripheral detachment of the implant was noted. Rebubbling was required thrice with augmentation of the anchoring sutures. At 45 days of follow-up, EndoArt was principally attached.

**Conclusions:** A novel suture pull-through technique of EndoArt implant insertion can be used for ensuring higher safety in complex cases like aphakia, aniridia, and vitrectomized eyes to prevent implant dislocation into the vitreous cavity.

**Key Words:** EndoArt, suture pull-through, endothelial decompensation

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## CASE REPORT

Techniques of endothelial keratoplasty (EK) like Descemet stripping automated endothelial keratoplasty (DSAEK) and

Descemet membrane endothelial keratoplasty (DMEK) are important for the surgical management of patients with corneal endothelial decompensation in the absence of significant stromal scarring.<sup>1,2</sup> DMEK has become the most common keratoplasty procedure in Germany since 2016.<sup>3</sup> Good outcome with early visual recovery can be achieved, but there are chances of graft failure in certain high-risk patients, posing the need for repeat endothelial transplantation.<sup>4</sup> Also, in few countries owing to the lack of awareness regarding eye donation, there is a shortage of corneal tissues for transplant, leading to a prolonged waiting list and delay.<sup>5</sup> In both scenarios, EndoArt seems to be a good substitute, especially for eyes at high risk of graft failure after conventional EK with lower visual potential.<sup>6</sup> EndoArt (EyeYon Medical, Ness Ziona, Israel) is an artificial dome-shaped endothelial layer made up of a flexible, hydrophilic acrylic material, with a diameter of 6.5 mm, thickness of 50 µm, and posterior curvature of 6.8 mm. When placed over the posterior stroma of the recipient, it acts a barrier to the entry of aqueous humor into the corneal stroma, which when combined with epithelial evaporation eventually reduces the corneal edema maintaining corneal homeostasis.<sup>7</sup> The implant can be inserted through a clear corneal tunnel into the anterior chamber (AC) either by injecting it through an intraocular lens (IOL) cartridge or by using a push-through technique by sliding it into the AC with a blunt-tipped spatula.<sup>7,8</sup> Although the implant is fixed with transcorneal sutures, it is initially free-floating in the AC after implantation. In difficult scenarios like aniridia, aphakia, and vitrectomized eye, there is a chance of posterior dislocation of the implant into the vitreous cavity. Recently, a pull-through technique with the help of 27-gauge curved DMEK forceps has been described to prevent dislocation of the implant.<sup>9</sup> However, there is also a risk of losing the implant if the forceps grip becomes loose. In a similar case scenario, we have established another pull-through technique with the help of 10-0 prolene suture to prevent graft dislocation (Video 1).

This is a case of a 59-year-old woman who had a road traffic accident leading to wind shield injury to both eyes 41 years ago. There was a complete loss of vision in the right eye due to damage to the optic nerve. The left eye was diagnosed to have open globe injury with corneal perforation, aphakia, and aniridia, which had undergone primary corneal tear repair. Later, she developed secondary glaucoma in the left eye for which cyclophotocoagulation was performed in 2002. Artificial iris diaphragm placement along with scleral-fixated IOL placement was performed in October 2018, followed by DMEK in January 2019 requiring rebubbling thrice in view of graft detachment. Best-corrected visual acuity (BCVA) in logMAR after 6 months of follow-up was 0.2, which dropped down to 0.6 1 month later due to graft failure. Repeat DMEK was performed in March 2021, which required 3 rebubbings, and BCVA at follow-up was 0.3

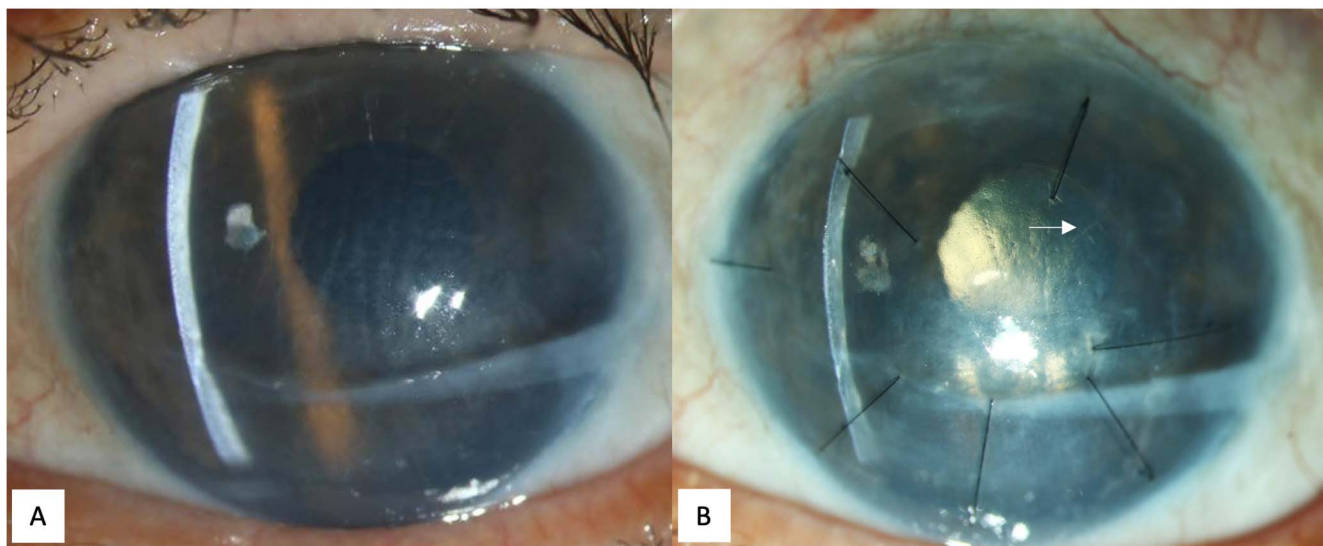
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**FIGURE 1.** Slit-lamp photographs (A) preoperatively and (B) at 45 days of follow-up after EndoArt implantation. White arrow in (B) shows the 'F' mark denoting the correct orientation of the EndoArt. EndoArt is kept in place with 6 interrupted 10-0 nylon sutures.

logMAR. Vision dropped to 0.6 in January 2022 and 1.1 logMAR by February 2023 as a result of repeat endothelial decompensation. A third DMEK was performed in February 2024 followed by rebubbling the next day. Upon 5 days of follow-up, the patient started complaining of visualization of a floating opacity in the superior visual field, and on examination, graft was noted to be completely detached and displaced into the anterior vitreous phase due to a larger gap between the artificial iris diaphragm and scleral-fixed IOL.

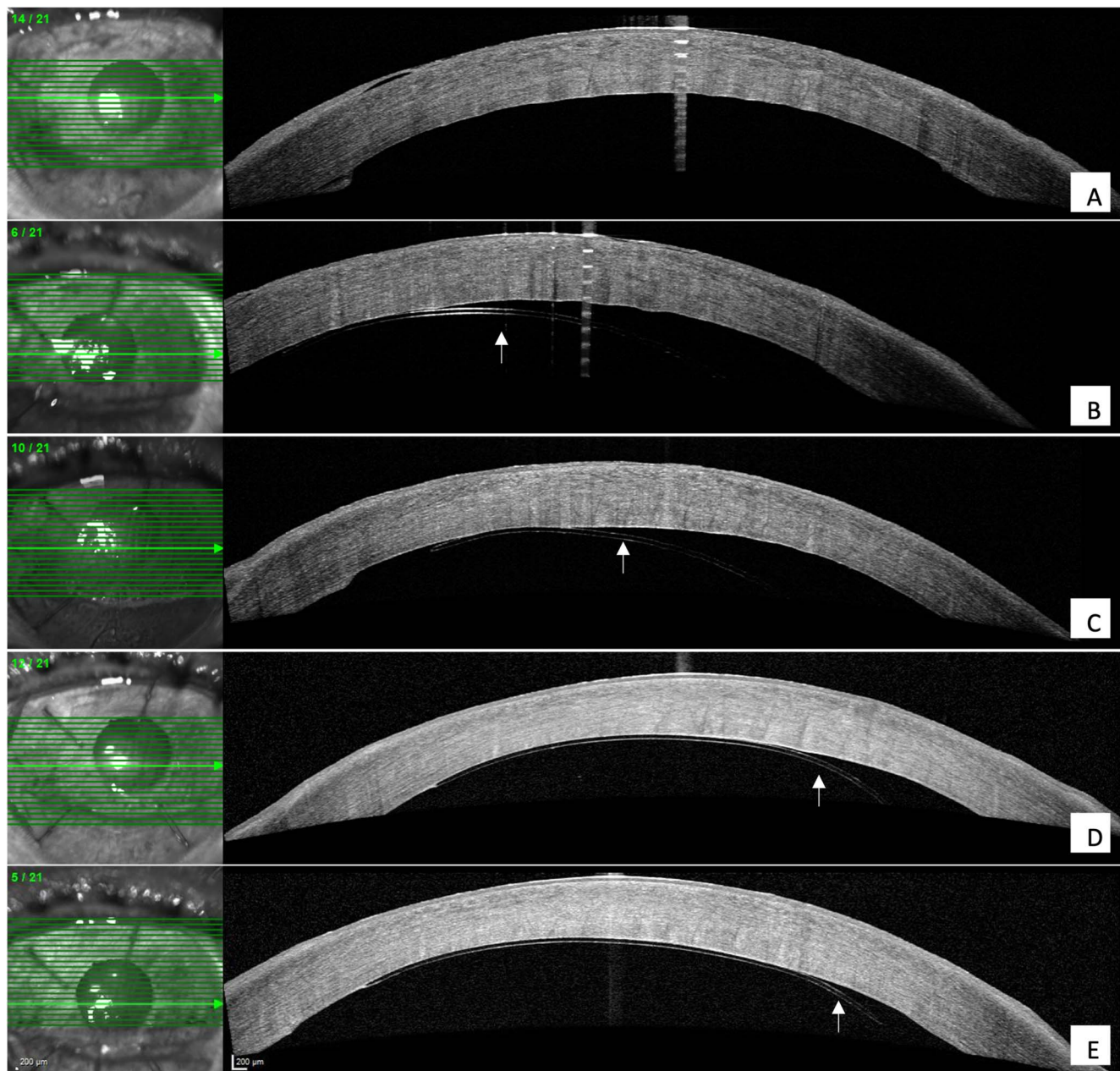
In view of multiple failed DMEK procedures, EndoArt implantation was planned. A superior corneal tunnel was made of 2.5 mm, and paracentesis were made at 2 and 10 o'clock positions. The prior DMEK graft could be visualized just over the upper edge of the IOL and was removed with McPherson forceps. To prevent implant dislocation, similar to the suture pull-through technique described for DSAEK lenticule insertion, one end of a double-ended 10-0 prolene suture with CIF-4 needle was passed first through the EndoArt.<sup>8</sup> Other options could have been use of an STC-6 needle or CTC-6 needle with 10-0 prolene suture. The left needle was introduced into the AC from the superior corneal tunnel and passed through the midperipheral host cornea at the 6 o'clock position, followed by passing of the right needle approximately 0.5 mm away from the left. The EndoArt was then gently pulled through the main incision into the AC by pulling the prolene suture ends while pushing the implant with a spatula. It was positioned centrally, and the prolene suture was tied to prevent dislocation of the implant into the vitreous. Air bubble followed by 12% C3F8 was injected into the AC underneath the EndoArt. All paracentesis and main tunnel incisions were sutured with 10-0 nylon sutures, and the implant was anchored in place with 3 sutures at 2, 8, and 10 o'clock positions passing through the implant and the full corneal thickness. For this, another described technique could be the use of safety-basket sutures instead of interrupted anchoring sutures.<sup>10</sup> Full chamber 12% C3F8 bubble was ensured at the end

of surgery, and correct orientation of the implant was checked by the irreversible F mark. The prolene suture was removed at the end of the surgery.

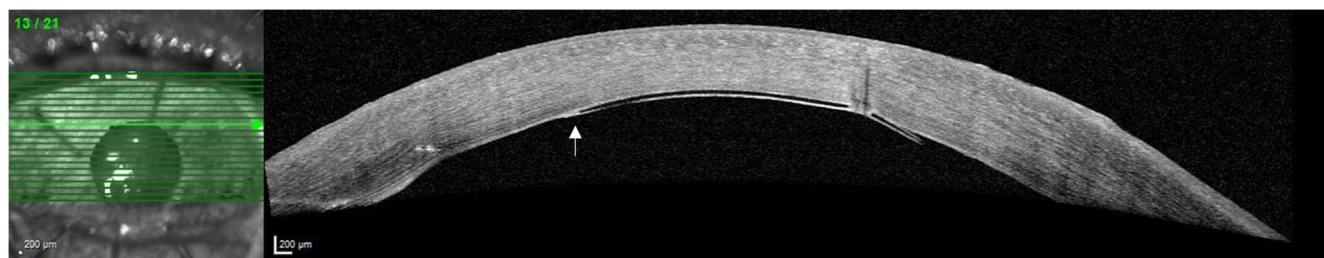
Upon follow-up, peripheral detachment of the EndoArt was noted and rebubbling was performed thrice along with augmentation of the anchoring sutures (Fig. 1). At 1 ½ month of follow-up, EndoArt was noted to have attached, except for minimal temporal detachment, and BCVA was noted to be increased from 1.22 logMAR before surgery to 0.8 logMAR (Fig. 2). The central corneal thickness decreased from 1062 µm before surgery to 751 µm at apex in the 1 ½ month follow-up, with the thinnest pachymetry being 662 µm. On AS-OCT, fibrosis could be noted near the edge of the EndoArt at the 11 o'clock position indicating dense adhesion in this peripheral area (Fig. 3).

We describe a novel suture pull-through technique for EndoArt insertion. It can be noted that the EndoArt material is resilient and despite passing the sutures, no tear was noted and the implant could be stabilized in place with ease. This simple technique increases safety in complex cases like aphakia, aniridia, and vitrectomized eyes where there can be chances of dislocation of the implant into the vitreous cavity.

A superior corneal tunnel was made followed by paracentesis at the 2 and 10 o'clock positions. Prior dislocated DMEK graft was explanted. One end of a double-ended 10-0 prolene suture with a CIF-4 needle was passed first through the EndoArt. The left needle followed by the right needle was introduced into the AC from the superior corneal tunnel and passed through the midperipheral host cornea at the 6 o'clock position. The EndoArt was pulled through the main incision into the AC by pulling the prolene suture ends while pushing the implant with a spatula, and the prolene suture was tied. Air bubble followed by 12% C3F8 was injected underneath the EndoArt. All incisions were sutured and the implant was anchored in place with 3 sutures at 2, 8, and 10 o'clock positions passing through the implant and the full corneal thickness. The prolene suture was removed at the end of the surgery.



**FIGURE 2.** AS-OCT images (A) preoperatively and (B) on postoperative day 1; detached EndoArt (arrow) can be identified by a double contour indicating the anterior and posterior surface of the device; (C) 3 days after first rebubbling (5 days after EndoArt); (D) 25 days after second rebubbling (1 month after EndoArt); (E) 11 days after third rebubbling (1 ½ month after EndoArt). Peripheral detachment of EndoArt has decreased after each rebubbling (arrow).



**FIGURE 3.** AS-OCT image showing fibrosis near the edge of the EndoArt at the 11 o'clock position (arrow).

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