

Endothelial keratoplasty combined with scleral fixation intraocular lens

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Dear Editor,

We describe, for the first time, the surgical management of two aphakic patients with corneal decompensation treated with concomitant ultrathin-Descemet stripping automated endothelial keratoplasty (UT-DSAEK) and implantation of two different scleral-fixated (SF) intraocular lenses (IOLs), namely sutureless SF (SSF) Carlevale IOL (Soleko, Italy; Figure 1) or Morcher Type 90L IOL (Morcher GmbH, Germany; Figure 2). Both IOLs are hydrophilic acrylic. The Carlevale IOL is 13.2 mm long with a 6.5 mm optic plate, foldable and injectable through a 2.2 mm corneal tunnel. A T-shaped harpoon protrudes off the closed haptics and is designed to be externalized underneath a partial thickness scleral flap (Figure 1). The Morcher Type 90L IOL is 15 mm long with a 6.5 mm optic plate. The two C-loop haptics have an eyelet for the passage of the sutures for the scleral fixation (Figure 2).

Vision impairment resulting from aphakia in absence of capsular support may be effectively managed with the

implantation of a variety of IOLs including anterior chamber (AC), iris-fixated and scleral-fixated IOLs^[1]. In cases of concomitant corneal decompensation, the combination of corneal transplant with IOL scleral fixation has been proposed as a safe and effective option to address issues with both the cornea and the lens leading to a faster visual rehabilitation^[2-4]. Moreover, modern endothelial keratoplasty (EK) and new generation foldable SF IOLs allow to perform minimally invasive procedures to be undertaken.

Two patients with corneal decompensation and aphakia were referred to the corneal service in the Royal Liverpool University Hospital, for evaluation of secondary IOL implant and corneal transplant. Patients were properly informed about their inclusion and signed an informed consent form. The study complied with the principles of the Declaration of Helsinki, and was approved by the Clinic Ethics Committee.

CASE 1

A 79-year-old man presented with pain and reduction of vision due to aphakia and corneal decompensation in his right eye. He had a history of complicated cataract surgery with dropped nuclear fragments followed by pars plana vitrectomy (PPV) and iris-claw Artisan IOL implantation. His initial surgery was complicated by postoperative persistent cystoid macular oedema for 8mo later and he had undergone subsequent Artisan IOL removal complicated by aphakic corneal endothelial decompensation. At presentation, ophthalmic examination of the right eye demonstrated best corrected visual acuity (BCVA) of counting fingers (CF), intraocular pressure (IOP) 16 mm Hg, corneal edema, Descemet's folds, aphakia and absence of capsular support. Fundus examination demonstrated attached retina and absence of cystoid macular edema on optical coherence tomography scans. Endothelial cell density (ECD) was not measurable. The patient underwent to combined Carlevale IOL SSF implantation and UT-DSAEK.

Surgical Technique The surgery was performed under peribulbar anesthesia. The technique used for SSF Carlevale IOL implantation was that described by Barca *et al*^[5]. Two limbus landmarks were marked along the horizontal meridian at 0°-180° degrees. After two limited conjunctival peritomies, two scleral flap of 4×4 mm² and two sclerotomies 1.5 mm away from the limbus were performed at 0°-180°. This was

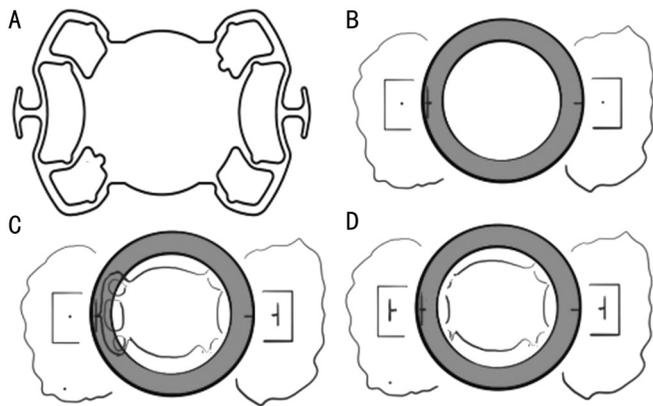


Figure 1 Schematic diagram of the Carlevalle IOL and representation of surgical of implantation A: Carlevalle IOL; B: Temporal and nasal scleral flap at 0°-180°, temporal corneal wound and nasal paracentesis; C: The leading harpoon is externalized; D: Final position of Carlevalle IOL once also the trailing harpoon is externalized.

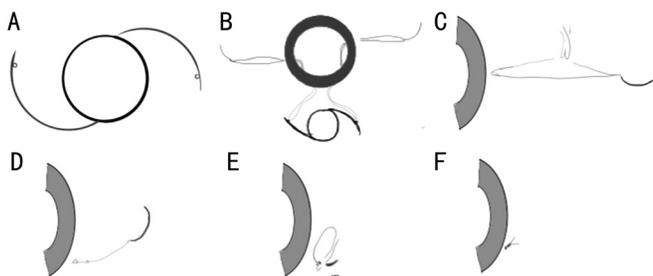


Figure 2 Schematic diagram of the Morcher Type 90L IOL and representation of surgical of implantation A: Morcher Type 90L IOL; B: Each IOL haptic are locked by a looped 10-0 polypropylene suture. The loops are externalized through partial-thickness sclera at 2 and 8 o'clock; C: After cutting one string of the externalized looped suture, the armed end is passed through partial-thickness sclera for about 0.5 mm. D: Creation of two knots, one in correspondence of the scleral bite and the second one 4-5 mm away from it. E: Creation of a half-thickness scleral tunnel of about 2-3 mm using the needle. F: Suture ends are buried into the tunnel.

followed by the creation of a temporal corneal wound of 2.75 mm and a nasal paracentesis. Concomitantly to the injection of the Carlevalle IOL through the corneal incision, 25 G forceps were inserted through the nasal sclerotomy to grasp the leading T-shaped harpoon. Once the leading harpoon was externalized, the trailing harpoon was grasped with the first 25 G forceps inserted through the paracentesis and passed to other 25 G forceps inserted through the temporal sclerotomy using the handshaking technique. The second T-shaped harpoon was externalized without any further manoeuvres on the IOL (Figure 1). After the suture of the scleral flaps, an AC maintainer was inserted through a paracentesis, and a descemetorhexis was performed. Using the iGlide a preloaded ultrathin DSAEK was delivered through the main paracentesis using 25 G forceps (pull through technique). Once delivery

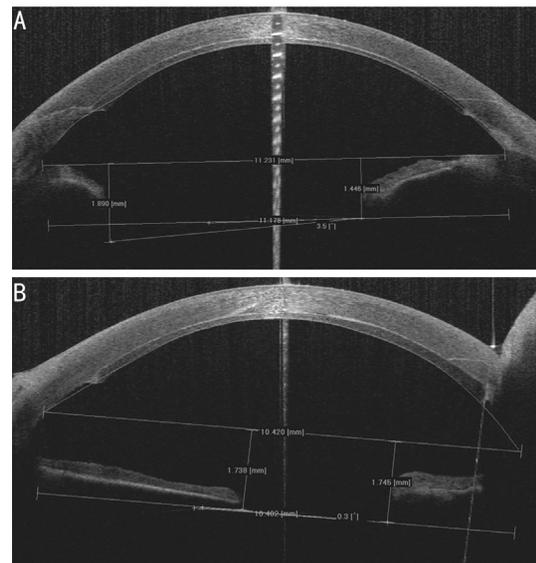


Figure 3 IOL tilt angle of Carlevalle IOL A: Horizontal plan; B: Vertical plan.

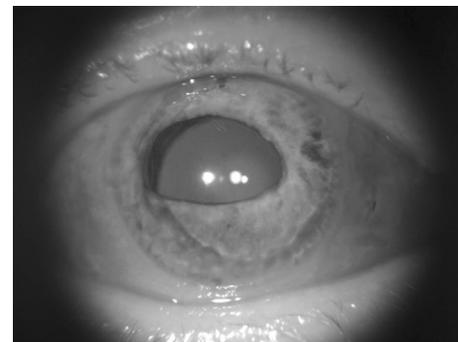


Figure 4 Anterior segment picture of the right eye of the patient who underwent combined Carlevalle IOL SSF implantation and UT-DSAEK at 9-month follow-up.

was completed, the tissue was held with forceps until it was unfolded and attached. An air bubble was injected into AC to secure the graft to the corneal stroma. Finally, the corneal incision was sutured with 10-0 nylon and the conjunctiva with 8-0 vicryl. The patient was positioned supine for 36h. No intraoperative complications occurred.

Postoperative therapeutic regimen included chloramphenicol 0.3% for 2wk and dexamethasone phosphate 0.1% every 2h for 1wk, then 4 times a day for 4mo then twice a day long term.

Follow-up The BCVA progressively improved from CF to 20/80 at 9-month follow-up. The IOP remained within normal limits. The corneal graft appeared well apposed, clear and centred, the IOL in place and the retina secure. The mean IOL tilt was 1.9°, calculated by averaging the IOL tilt angle on the vertical plane (0.3°) and the horizontal plane (3.5°; Figures 3, 4). As proposed by Yamane *et al*^[6], the IOL tilt was considered the angle between the IOL horizontal axis and a straight reference line between the iridocorneal angles of each side. No postoperative complication was noted during the follow-up (FU).

CASE 2

Fifteen months prior to presenting in the clinic, a 56-year-old man was treated with PPV, silicone oil (SO) tamponade and inferior iris suture with no IOL implantation in the left eye for partial aniridia, dropped crystalline lens and retinal detachment following ocular trauma. Three months after, the SO was removed and the patient developed progressive corneal edema. At presentation, the left eye had BCVA of CF, IOP 21 mm Hg, corneal edema, Descemet's folds, inferior iris suture with residual superotemporal iris defect and aphakia with no capsular support, retina apparently flat. The central corneal thickness was 784 μm and ECD not measurable. The patient underwent combined UT-DSAEK and implantation of SF Morcher Type 90L IOL.

Surgical Technique The surgery was performed under peribulbar anesthesia. The technique used for SF was that described by Kir *et al*^[7], without any scleral flap. Briefly, two limbus landmarks were marked at 2 and 8 o'clock. The eyelet of each IOL haptic was engaged and locked by a looped 10-0 polypropylene suture. The curved needles were externalized 1 mm away from the limbus passing through the ciliary sulcus. After the injection of the IOL in the ciliary sulcus, the externalized loop was cut and the armed end passed through partial-thickness sclera for about 0.5 mm. Two knots were created, the first in correspondence of the partial-thickness scleral bite and the second 4-5 mm away from the first. The needle was then used to create a half-thickness scleral tunnel of about 2-3 mm and, after cutting the second knot, the suture ends were buried into the tunnel (Figure 2). Then, a corneal wound of 2.75 mm at 90° was created and the UT-DSAEK was performed as in patient 1. No intraoperative complications occurred. Postoperative management was the same as received by patient 1.

Follow-up At 2-month postoperative FU, left IOP was 28 mm Hg; therefore dexamethasone phosphate 0.1% was switched to loteprednol etabonate 0.5% and the combination of bimatoprost (0.3 mg/mL) and timolol (5 mg/mL) once a day was started. At last FU, 8mo after surgery, BCVA was 20/100, IOP well controlled, the corneal graft clear and well attached, the IOL well centered with mean IOL tilt of 9.75° (Figures 5, 6).

DISCUSSION

Bullous keratopathy can accompany aphakia following complicated cataract surgery or ocular trauma resulting in severe visual impairment^[2]. Modern UT-DSAEK has been demonstrated to provide fast, reproducible and effective rehabilitation of corneal endothelial disease^[8]. Recently, DSAEK has been successfully combined with iris clipped, glued and flanged intrascleral IOLs for the management of aphakic bullous keratopathy^[2-4,9-10]. Combined surgeries offer several significant advantages, such as optimization of

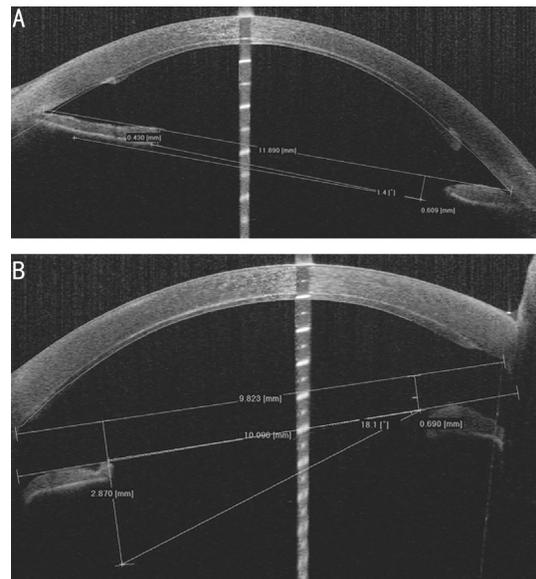


Figure 5 IOL tilt angle of Morcher Type 90L IOL A: Horizontal plan; B: Vertical plan.

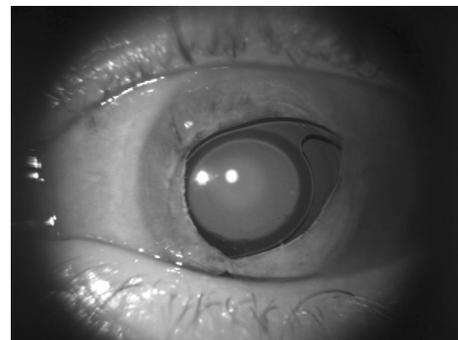


Figure 6 Anterior segment picture of the left eye of the patient who underwent combined UT-DSAEK and implantation of SF Morcher Type 90L IOL at 8-month follow-up.

surgical time, avoiding multiple sequential surgeries and faster visual rehabilitation^[2-3]. Moreover, in aphakic eyes treated with endothelial transplant, concomitant IOL implantation can reduce the risk of migration of the graft into the vitreous chamber and support graft attachment helping to maintain the bubble of air in the AC^[10].

Compared with AC-IOLs and iris-fixated IOLs, scleral-fixated IOLs could be favored due to the absence of corneal and angle trauma with potentially reduced endothelial cell loss, decreased risk of pupillary block and secondary glaucoma, minimal or no contact with the iris and smaller corneal incision due to their foldability^[1]. We present two cases of DSAEK combined, for the first time, with SSF Carlevalle IOL implantation in one eye and SF of Morcher Type 90L IOL in the second eye, demonstrating the feasibility and effectiveness of these procedures. The scleral fixation of IOLs is a valuable procedure in aphakic eyes and has been traditionally performed using 10-0 polypropylene sutures^[11]. However, several concerns exist over suture-related complications, such as knot erosion, infection, IOL tilt and suture slippage or degradation

with consequent long term IOL instability^[4,12]. In particular, IOL tilt can impact significantly on the vision even in case of successful surgery; indeed, an IOL tilt of about 5° can cause additional refractive error, whereas higher-order aberrations not correctable with spectacles can be induced by IOL tilt >15°^[13]. In combination with EK, this potential complication can also be more relevant considering that the EK itself has been associated with a potential mild hyperopic shift^[7]. In our report, visual acuity markedly improved in both patients but the tilt angle of Carlevalle IOL was significantly smaller than that of Morcher IOL. This is consistent with previous case series highlighting the ease of implantation and stability of Carlevalle IOL^[5,14]. Barca *et al*^[5] suggested that the low tilt degree of Carlevalle IOLs may be related to the presence of a harpoon instead of the haptic, as the former could tolerate better the stress of the surgical manipulation without deforming.

In conclusion, the combination of UT-DSAEK with both SSF of Carlevalle IOL and SF Morcher Type 90L IOL appeared to be an effective and safe option for the surgical management of corneal decompensation in aphakic patients resulting in good visual and anatomical outcomes. However, Carlevalle IOL was easier to handle and resulted in a smaller IOL tilt angle, overcoming potential complications related to sutured SF, such as pseudophaco-donesis, IOL instability, IOL tilt, haptic erosion and suture lysis.

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