



Descemet Membrane Endothelial Keratoplasty with cornea press technique and implantation of a Carlevale scleral-fixated intraocular lens

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ABSTRACT

Purpose: We describe a combined Descemet Membrane Endothelial Keratoplasty (DMEK) using the Cornea-press (C-Press) technique, with implantation of a new sutureless, scleral fixated intraocular lens (IOL) (Carlevale, Soleko), in a case of bullous keratopathy and IOL mispositioning.

Observations: Two scleral pockets were created along two scleral radial incisions, 180° apart, followed by two 23 G sclerotomies at the pockets' sites. After removal of the dislocated IOL through a corneoscleral incision, posterior vitrectomy was completed. The Carlevale IOL was injected into the anterior chamber (AC) and placed above the iris. The haptics were then externalized using opening distal forceps through the sclerotomies, and the plugs were secured in the scleral pockets. DMEK was then performed using the "C-press" technique, where corneal indentation allowed to artificially shallow the AC to ensure successful graft unrolling. Fifteen months postoperatively, the cornea was clear, the Carlevale IOL well positioned, and the patient's vision improved.

Conclusions and importance: DMEK using the C-Press technique, combined with a sutureless, scleral-fixated IOL such as the Carlevale in a single procedure, may be a safe and effective option to restore vision in case of bullous keratopathy and dislocated IOL.

1. Introduction

Descemet Membrane Endothelial Keratoplasty (DMEK) has gained in popularity over other surgical techniques in the management of corneal decompensation in cases of Fuchs dystrophy or bullous keratopathy (BK),¹ mainly because of faster and better visual recovery, as well as lower rejection rates.^{2,3} In vitrectomized eyes, lack of posterior support from the vitreous causes the anterior chamber to deepen intraoperatively and renders graft unfolding very challenging.^{4,5} We recently described the "C-Press" or "Cornea-Press" technique, during which the indentation of the cornea allows a shallowing of the anterior chamber and a safe and reproducible unrolling of the graft.⁶

In cases of dislocated intraocular lens (IOL) with bullous keratopathy (BK), DMEK can be performed with implantation of a posterior iris-claw IOL,⁷ sutured⁸ or glued⁹ scleral fixated (SF) IOL. Recently, a new foldable, sutureless scleral-fixated IOL, the Carlevale (Soleko, Italy), has been introduced, with promising long-term results regarding safety and efficacy, allowing good functional recovery and minimal complications in cases of secondary implantation.¹⁰

We present the case of a patient with BK and a dislocated iris-claw

IOL who underwent combined DMEK, using the C-Press technique, with IOL exchange and implantation of a Carlevale IOL. To the best of our knowledge, this is the first report in literature of a DMEK combined with this new IOL implantation.

2. Case report

A 59-year-old male patient was referred to our practice for pseudo-phakic BK of the right eye. He had undergone a complicated cataract surgery seven years ago, with posterior capsular rupture, vitrectomy, and secondary implantation of an anterior iris-claw IOL, then a repositioning of the IOL due to dislocation following blunt trauma of the right eye. At presentation, his visual acuity was limited to counting fingers. Slit lamp examination revealed BK with a nasally dislocated anterior iris-claw IOL, vitreous strands in the AC and localized iris atrophy. Central pachymetry was measured at 651 μm with corneal OCT (Avanti, Optovue, Fremont, USA) (Fig. 1).

We decided to proceed with DMEK using the "C-Press" technique, combined with IOL exchange and sutureless, scleral-fixated Carlevale IOL implantation.

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Patient: KANTE, MAMADOU
 Physician:
 Operator:
 Disease:

HOPITAL FONDATION ROTHSCHILD
 Gender: Male
 ID:

Exam Date: 12/04/2021
 DOB(age): 28/01/1963 (59)
 Ethnicity:
 Algorithm Ver: A2018,1,1,63

PachymetryWide

Signal Strength Index 51

Right / OD

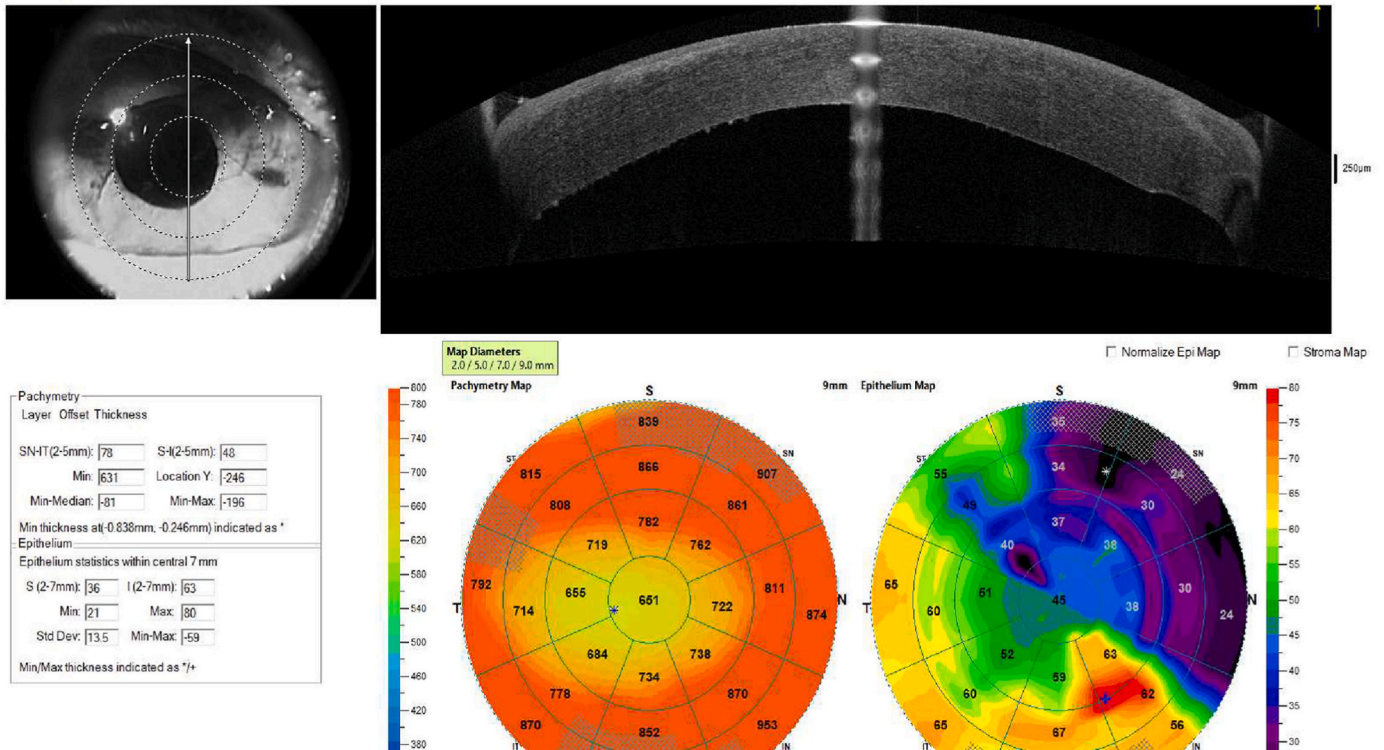


Fig. 1. Preoperative corneal Optical Coherence Tomography scan of the right eye revealing corneal edema and highly irregular epithelial mapping.

The corneal graft was prepared before the patient was brought into the operating room. Donor age was 71 years. Graft diameter was 8.25 mm, based on the corneal diameter of the recipient, and had an endothelial density of 2700 cells per mm². The procedure was performed under peribulbar block. The right eye was prepped and draped in a sterile fashion. Central epithelium was manually removed to better visualize the anterior chamber, and localized conjunctival peritomy was performed at 3, 9 and 12 o'clock positions (Video 1). Two 3 × 3 mm scleral pockets were made at the limbus at 180° apart. A superior 5 mm scleral tunnel was made using a crescent knife and 2.4 mm slit knife, to explant the iris-claw IOL using opening distal forceps. A 2.2 mm clear corneal incision with two side ports 120° apart was performed. The scleral tunnel was closed with three interrupted 10/0 nylon sutures, before posterior vitrectomy was completed. After filling the AC with a viscoelastic solution (Provisc, Alcon, USA), the Carlevalle IOL was injected through the clear corneal incision using a Viscojet Injector (Medical Viscojet 2.2 mm), and placed above the iris. The haptics were then externalized using opening distal forceps through the sclerotomies, by grasping the extremity of the plugs; IOL centration was achieved without performing any additional intraoperative maneuvers. Scleral pockets and conjunctival wounds were sealed with 8-0 Vicryl (Ethicon Inc, Somerville, NJ). The viscoelastic solution was thoroughly removed using an irrigation-aspiration (IA) cannula. The infusion cannula was removed and the port was plugged before proceeding with DMEK. Descemetorhexis was performed through a paracentesis using an inverted Sinsky hook after filling the AC with air for better visualization. The recipient's Descemet membrane was removed, and absence of membrane remnants was verified using intraoperative OCT (Rescan, Zeiss Meditec, Germany). The donor Descemet membrane was loaded into a glass cannula (Geuder AG, Heidelberg, Germany) and injected into the AC through the 2.2 mm clear corneal incision. The double roll

graft was then rotated parallel to a paracentesis, using the “no-touch” technique, by tapping and injecting Balanced Salt Solution (BSS). A cannula was inserted inside the double roll on the Descemet side and moved laterally to open the graft. A second cannula was simultaneously used to maintain pressure on the cornea centrally, thus creating an artificially shallow AC and allowing for the graft to remain unrolled. The first cannula was then removed from the AC and used for tapping on the cornea to unroll the graft while verifying the correct orientation with OCT. The assistant prepared a third cannula mounted on a 1 mL syringe, which was inserted beneath the graft by the surgeon, while maintaining constant pressure on the cornea. A small air bubble was injected while releasing the corneal pressure. After verifying the absence of graft folds and adhesion to the posterior stroma, the AC was completely filled with a 20% sulfur-hexafluoride 6 (SF6) gas bubble for 10 minutes, then bubble size was reduced to 80% of the AC volume by injecting BSS. No peripheral iridectomy was performed. The sclerotomy site was sutured using 8-0 Vicryl after removal of the trocar. A Phenylephrine chlorhydrate 5.4 mg + tropicamide 0.28 mg insert (Myriasset, Thea Pharmaceuticals Ltd., Clermont-Ferrand, France) was placed beneath the lower eyelid to ensure postoperative pupil dilation and avoid pupillary block.

The patient remained in a strictly supine position for 2 hours and was then examined to ensure the absence of pupillary blockage, and that the gas bubble lower margin was above the pupil lower margin, before being discharged home and instructed to remain supine for the next 24 hours.

3. Results

At the first postoperative day examination, the insert and contact lens were removed, graft adhesion was verified, and intraocular pressure (IOP), measured by both puff and applanation tonometry, was normal. Prednisolone acetate 1% and moxifloxacin 0.5% eye drops were started

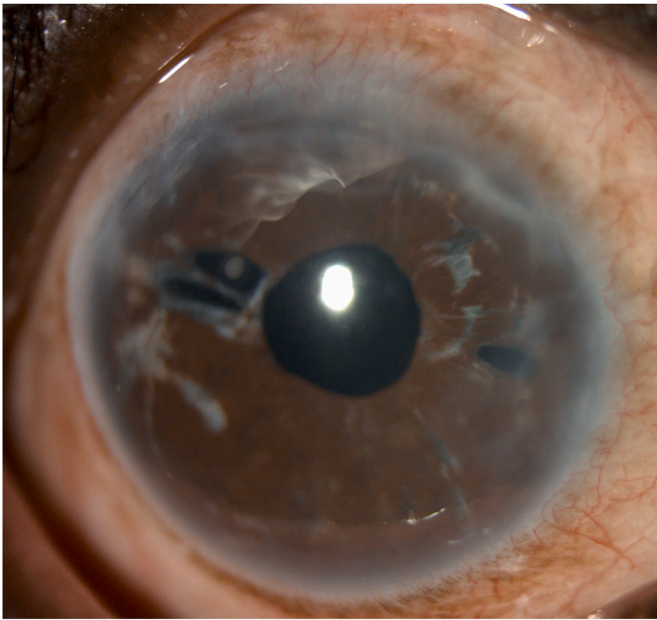


Fig. 2. Slit-lamp photograph of the right eye, at 15 months postoperatively, depicting a clear cornea with a well attached DMEK graft, iris defects and a centered Carlevalle IOL.

4 times per day each in the operated eye. Moxifloxacin was stopped one week after surgery, and prednisolone was slowly tapered down to once daily during a 3-month period. During early postoperative period, the graft remained attached, and no rebubbling was needed. At 15 months

postoperatively, best-corrected visual acuity (BCVA) was 0.7 with +1 (−3.50)115°, IOP was at 9 mmHg, the graft was clear and attached with no sign of rejection, and the Carlevalle IOL was well centered (Fig. 2). Dilated funduscopy was normal, and OCT of the macula and RNFL were within normal limits. Central pachymetry was measured at 528 μm with corneal OCT (Fig. 3).

4. Discussion

We previously described the “C-press” or “Cornea-press” technique,⁶ with standardized steps allowing to successfully unroll the DMEK graft in vitrectomized eyes, without touching the graft, no recurrent globe collapse, and shorter manipulation time. It allowed for successful, safe and reproducible DMEK surgery in 11 vitrectomized eyes in our first case series study in 2019, with an unfolding time of 4.4 ± 2.5 minutes, and 2 cases of rebubbling for partial detachment (18%).

Peripheral iridotomy was not performed, and pupillary block was avoided by ensuring that the gas bubble lower margin was above the dilated lower pupil margin before discharging the patient, as described in the “PI-less DMEK” technique.¹¹

The Carlevalle IOL is a single-piece, foldable, hydrophilic acrylic, monofocal IOL, equipped with two small plugs on each of the two haptics, allowing to anchor the lens through partial thickness scleral pockets, with a self-blocking mechanism. In this case, Carlevalle IOL was preferred to other glued or sutured scleral fixated IOLs because of its foldable nature, which allows for a shorter intraoperative time, insertion through a 2.2 mm corneal incision, and does not require suturing or gluing the haptics to the sclera, thus avoiding complications such as IOL tilt and suture erosions.^{12,13}

During C-Press, dislocation of a scleral-fixated IOL may be a dreaded complication due to increased pressure in the anterior chamber. In the

Patient: KANTE, MAMADOU
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 Disease:

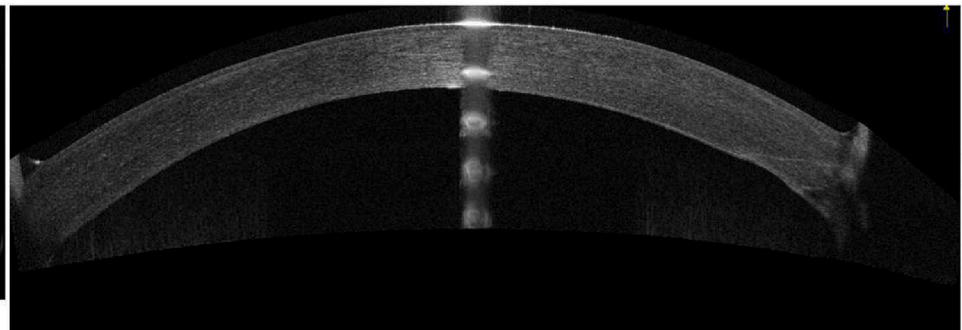
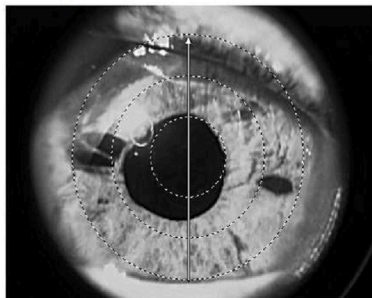
HOPITAL FONDATION ROTHSCHILD
 Gender: Male
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PachymetryWide

Signal Strength Index 35

Right / OD



250μm

Pachymetry	
Layer	Offset Thickness
SN-I (2-5mm):	[87] S-II (2-5mm): [83]
Min:	[502] Location Y: [-1301]
Min-Median:	[-50] Min-Max: [-124]
Min thickness at: 0.636mm, -1.301mm indicated as *	
Epithelium	
Epithelium statistics within central 7 mm	
S (2-7mm):	[40] I (2-7mm): [47]
Min:	[32] Max: [52]
Std Dev:	[3.6] Min-Max: [-20]
Min/Max thickness indicated as */*	

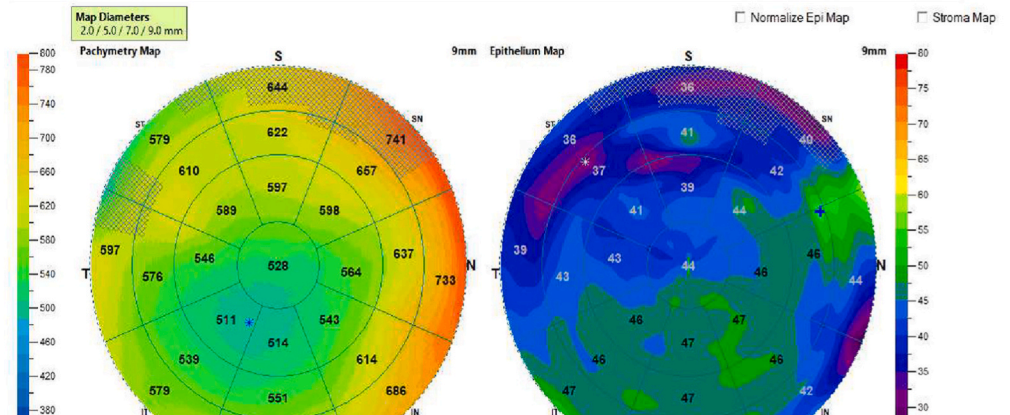


Fig. 3. Fifteen months postoperative corneal Optical Coherence Tomography of the right eye with regular normal pachymetry and epithelial mapping.

case of the Carlevale, C-Press was safely performed and the IOL remained stable during indentation and tamponade. In this case, we chose not to implant another iris-claw IOL due to recurrent dislocation of the previous one and localized iris atrophy.

Kymnionis et al. recently described a case of Descemet Stripping Automated Endothelial Keratoplasty (DSAEK) combined with Carlevale IOL implantation.¹⁴ However, compared to the C-Press technique, DSAEK induces less AC pressure variation that could put at risk the stability of the IOL.

The main tips for success of the combined procedure were the following:

- Iris claw explantation through a corneoscleral incision rather than a large 6 mm corneal incision to reduce surgically-induced astigmatism and avoid excessive hypotony during DMEK
- The two vitrectomy ports placed at the scleral pockets and used as lens plug fixation sites for the Carlevale, which is a safe and effective technique, due to fewer scleral wounds, as described by Caporossi et al.¹⁵
- Posterior graft dislocation during C-Press was avoided thanks to the large optical diameter of the Carlevale (6.5 mm) compared to the iris-claw (5.4 mm for the Artisan, Ophtec, FL, USA).

A potential limitation to combining DMEK and Carlevale IOL implantation is the possible increased risk of hydrophilic acrylic IOL calcification due to contact with air or gas. In a recent case report, Carlevale opacification appeared after multiple rebubbings of a DSAEK graft.¹⁶ However, we did not observe any calcification of the IOL nor loss of visual acuity at 15 months postoperatively, as the patient did not require any rebubbling.

Endothelial cell density measures were not performed during follow-up. However, corneal thickness was monitored with OCT, and no signs of rejection were detected at 15 months.

In conclusion, this case description demonstrates that DMEK using the C-Press technique, combined with a sutureless, scleral-fixated IOL such as the Carlevale in a single procedure, may be a safe and effective option to restore vision and corneal clarity in cases of corneal decompensation and dislocated IOL.

Patient consent statement

The patient consented to publication of the case orally.

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Authorship

All authors attest that they meet the current ICMJE criteria for Authorship.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence

the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.ajoc.2023.101882>.

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