

The role of AS-OCT in the diagnoses and treatment of retained Descemet's membrane–endothelial layer complex after penetrating re-keratoplasty. A case report and review of the literature

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To report the successful management of a retained Descemet's membrane–endothelial layer complex (DM-ELC) after penetrating re-keratoplasty in a patient with history of keratoconus and trabeculectomy. Femto-laser was used to cut both the host and the donor tissues. On postoperative day 1, a weak corneal suture and an endothelial detachment were detected. Re-bubbling and substitution of the weak suture were performed. The persistence of the membrane the day after with a clear lenticule led to the diagnosis of retained DM-ELC. Intraoperative OCT, trypan blue staining, and shifting bubble technique were used for the surgical removal of the supernumerary membrane.

Key words: AS-OCT, Descemet's membrane, endothelial layer, intraoperative OCT, penetrating re-keratoplasty, Trypan blue

Retention of the host's Descemet's membrane–endothelial layer complex (DM-ELC) is a rare complication of corneal penetrating transplantation.^[1] Intense corneal edema can lead to incomplete removal of the corneal tissue: Henderson *et al.*^[2] suggested that long-established stromal edema can weaken the attachment of the DM, predisposing it to its separation from the stroma. In slit-lamp biomicroscopic examination, it appears as a subtle transparent membrane creating a double anterior chamber, but postoperative conditions (i.e., corneal edema, Descemet folds, and blood in the anterior chamber) can obstruct its visualization. Anterior-segment optical coherence tomography (AS-OCT) helps in these situations, allowing an early diagnosis.^[3,4] Management includes Nd: YAG laser membranotomy^[5] or surgical approach.^[1] If misdiagnosed, supernumerary DM becomes fibrotic and leads to a decrease in visual acuity. Furthermore, it can alter aqueous humor circulation, inducing deterioration of graft endothelium.^[6]

Case Presentation

We report the case of a 74-year-old man with a history of keratoconus and glaucoma who underwent penetrating keratoplasty (diameter of the lenticulus: 8.50 mm, calculated using AS-OCT MS-39, Costruzione Strumenti Oftalmici [CSO],

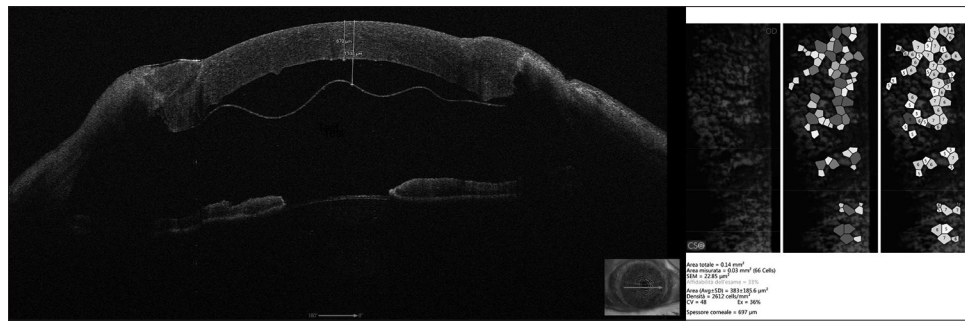


Figure 1: AS-OCT image (left) shows the persistence of the hyper-reflective membrane in the anterior chamber after the rebubbling. The endothelial biomicroscopy (right) shows a clear corneal graft with a conserved endothelial layer. Furthermore, the correspondence of the optical pachymetry [spessore corneale] (697 microns) and the thickness of the graft measured on the AS-OCT (670 microns) led us to the diagnosis

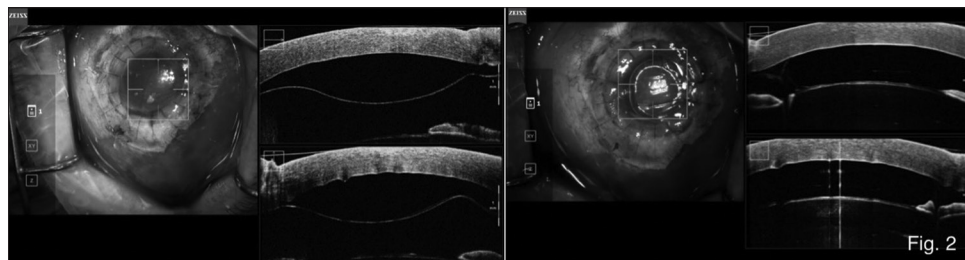


Figure 2: Intraoperative images: Comparison of intraoperative OCT images before (upper-left) and after (upper-right) endothelial removal

Firenze, Italy) and trabeculectomy, referred to our clinic for graft failure.

We programmed a mushroom cut pattern in both donor and host corneas by using the Ziemer FEMTO LDV Z8 device. Laser parameters were correctly adjusted for all the corneal approaches. On the host cornea, we performed an 8.95-mm-diameter anterior-side cut and an 8.50-mm-diameter posterior-side cut. On donor tissue, we programmed a 9.15-mm-diameter anterior-side cut and an 8.70-mm-diameter posterior-side cut. An artificial anterior chamber was used to cut the donor cornea. The graft was sutured with sixteen 10.0 interrupted nylon sutures.

On postoperative day 1, slit-lamp examination was hampered by stromal edema and reduction of anterior-chamber depth due to a weak corneal suture. AS-OCT showed a thin membrane floating in the anterior chamber under the lenticulus, diagnosed as endothelial detachment. The patient was scheduled for a new surgery to replace the weak corneal suture and to inject

an air bubble in the anterior chamber to induce the adhesion of the supposed detached endothelium to the overlying stroma.

On postoperative day 2, slit-lamp examination showed a transparent cornea with a well-formed anterior chamber, but a thin translucent membrane was noticed behind the graft, spreading all over the anterior chamber. AS-OCT showed the persistence of the same membrane under the graft, but endothelial biomicroscopy (Perseus Specular microscope, Costruzione Strumenti Oftalmici [CSO], Firenze, Italy) revealed a conserved endothelium. Therefore, the failure of air-bubble injection combined with a mild increase of stromal thickness and the persistence of a floating layer in the anterior chamber on the AS-OCT image led us to the diagnosis of a retained DM-ELC of the previous graft [Fig. 1].

We opted for surgical excision of the membrane. During the procedure, a 15° straight stab knife was used to make a limbal tunnel to enter the anterior chamber, directly in the space between the cornea and the retained membrane, live-guided by intraoperative OCT of the Artevo 800 microscope (Carl Zeiss Meditec, Inc.). Direct visualization of the retained DM-ELC was enhanced by trypan blue staining. An air bubble was

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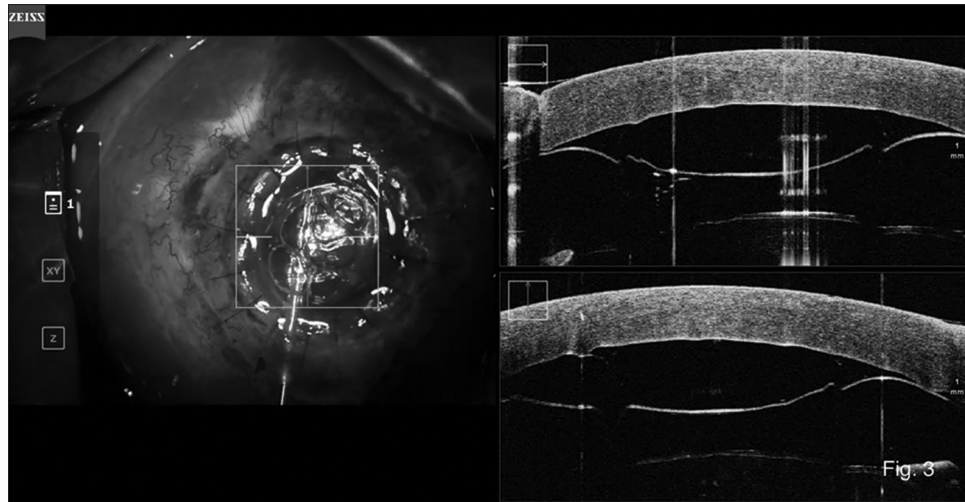


Figure 3: 25-G vitreoretinal forceps, OCT-guided, firmly catches the DM-ELC

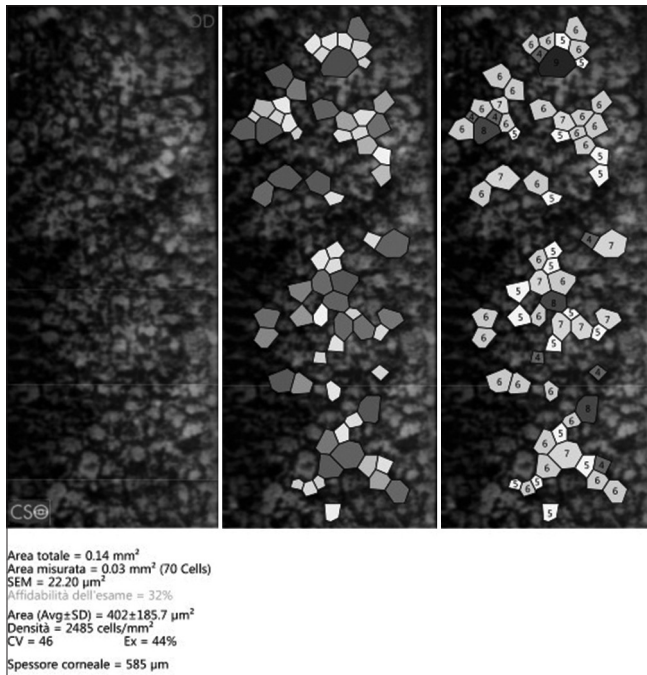


Figure 4: Endothelial biomicroscopy showing a conserved cellular density of the endothelial layer (Densità: 2485 cells/mm² vs. 2612 cells/mm²) and a reduced corneal thickness (585 microns vs. 697 microns) due to the resolution of the edema

injected between DM-ELC and graft lenticule to separate the membrane, allowing a safe descemetorrhesis by means of 25-G vitreoretinal forceps (Alcon/Grieshaber Revolution[®] DSP ILM forceps). Intraoperative OCT confirmed the removal of the residual DM-ELC [Figs. 2 and 3]. All entries were self-sealing, not requiring sutures.

Postoperative follow-up was successful: transparent corneal graft, unaffected endothelial cell count, *in situ* graft sutures, deep anterior chamber.

Discussion

Retrocorneal membrane after penetrating keratoplasty has different etiologies: inflammatory membrane, DM

detachment of the graft, epithelial growth, or retention of the host's DM-ELC.^[7] The last one has different possible causes, including incomplete trephination, ocular hypotony, fibrosis of the host cornea, and improper instillation of viscoelastic agents.^[8] In our case, we believe that the severe corneal edema led to a weak adhesion of the Descemet membrane to the overhead layer.^[2] Neodymium: YAG laser membranotomy was excluded due to the risk of damage to the donor's endothelial layer.^[8,9] The challenge of the surgical approach is to carefully identify the retrocorneal membrane.^[10] We balanced the risks by adopting careful strategies, such as staining the floating membrane by means of trypan blue, suspending and stabilizing it in the anterior chamber between a double air bubble, and using optical tomography to monitor all intraoperative maneuvers. Intraoperative OCT allowed us to perfectly localize the retained DM-ELC and remove it, respecting the endothelium and the integrity of the other graft layers. The proof was confirmed by endothelial biomicroscopy of the graft during the follow-up, where we detected a perfectly conserved endothelial cell density [Fig. 4]. We chose trypan blue because of its ability to color basement membranes and for its safety in the anterior chamber. Tying *et al.*^[11] reported triamcinolone acetonide as a good method to enhance visualization of vitreous and membrane, but its improper use in the anterior chamber can lead to harmful complications.^[12]

Conclusions

Retention of DM-ELC is a rare complication of corneal transplants and can lead to graft's failure. Even if this topic has already been approached in the literature [Table 1], this case, for the first time as far as we know, shows that retention of DM-ELC occurring during a penetrating re-keratoplasty can benefit intraoperative OCT to safely monitor all the intraoperative maneuvers. Thus, we propose an integrated approach with AS-OCT and intraoperative OCT for a prompt diagnosis and a safe surgical extraction of the membrane.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient (s) has/have

Table 1: Different diagnostic and therapeutic approaches to retained Descemet’s membrane–endothelial layer complex (DM-ELC)

Author	Diagnosis	Timing of diagnosis	Therapeutic approach (timing after diagnoses)	P.O. graft condition (last FU)
Ontiveros-Holguín <i>et al.</i> ^[1]	Slit-lamp examination	1 day PS	Nd:YAG laser + viscodissection + manual descemetorhexis	Clear graft (1 Y)
Tabuenca-Del Barrio <i>et al.</i> ^[5]	AS-OCT	4 months PS	Nd:YAG laser	Endothelial cell loss (1Y)
Choi <i>et al.</i> ^[8]	AS-OCT	4 months PS	Nd:YAG laser	Endothelial cell loss
Kremer <i>et al.</i> ^[9] (5 cases reported)	Slit lamp examination	3–4 months PS	Nd:YAG laser	Graft failure
Vengayil <i>et al.</i> ^[10]	AS-OCT	1 day PS	Automated vitreous cutter + trypan blue staining + manual descemetorhexis (3 weeks)	Clear graft
Tyring <i>et al.</i> ^[11]	AS-OCT	Not mentioned	Bimanual vitrectomy + forceps excision + triamcinolone acetamide	Clear graft
Sinha <i>et al.</i> ^[13]	Slit-lamp examination Slit-lamp examination	1 week PS 1 day PS	trypan blue staining + manual descemetorhexis (4 weeks) trypan blue staining + manual descemetorhexis (1 week)	Clear graft Clear graft (2 M)
Albuainain <i>et al.</i> ^[14]	Slit-lamp examination	1 day PS	Nd:YAG laser (5 months)	Endothelial cell loss (15 M)
Chen <i>et al.</i> ^[15]	Slit-lamp examination	1 day PS	Manual descemetorhexis (3 months)	Clear graft (2Y)
Masket <i>et al.</i> ^[16]	Slit-lamp examination	6 months PS	Nd:YAG laser	Clear graft
Lifshitz <i>et al.</i> ^[17]	Slit-lamp examination	Immediately PS	No intervention	Clear graft (33 M)
McVeigh <i>et al.</i> ^[18]	Slit-lamp examination	9 day PS	Surgical removal (5 months)	Clear graft (2W)
Lazar <i>et al.</i> ^[19]	Intentionally maintained during the surgery		No intervention	Clear graft (3Y)
Meeraalam <i>et al.</i> ^[20]	AS-OCT AS-OCT	6 months PS 1 day PS	FLS-assisted descemetorhexis + manual removal FLS-assisted descemetorhexis + manual removal	Clear graft Clear graft
Sharma <i>et al.</i> ^[21]	AS-OCT	3 months PS	Manual descemetorhexis	Clear graft (1M)

PS=post surgery, FU=follow-up, Y=year, M=month, W=week, FLS=femtosecond laser

given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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References

- Ontiveros-Holguín A, Pacheco-Padrón J. Inadvertent retention of Descemet membrane after penetrating keratoplasty for pseudophakic bullous keratopathy. *J Surg Case Rep* 2022;2022:rjac298.
- Henderson JW, Wolter JR. Separation of Descemet’s membrane in keratoplasty. *Am J Ophthalmol* 1968;65:375-8.
- Ide T, Yoo SH, Kymionis GD, Shah PA, O’Brien TR. Double Descemet’s membranes after penetrating keratoplasty with anterior segment optical coherence tomography. *Ophthalmic Surg Lasers Imaging* 2008;39:422-5.
- Khokhar S, Agarwal T, Gupta S, Sehra S, Panda A. Shifting bubble-guided sutureless technique for performing descemetorhexis for retained Descemet’s membrane after penetrating keratoplasty. *Int Ophthalmol* 2014;34:125-8.
- Tabuenca-Del Barrio L, Iturralde-Errea O, Mozo-Cuadrado M, Zubicoa-Enériz A, Plaza-Ramos P. Persistence of Descemet membrane and recipient-type endothelium after keratoplasty. A case report. *Arch Soc Esp Oftalmol (Engl Ed)* 2019;94:343-6.
- Patel SV, Hodge DO, Bourne WM. Corneal endothelium and postoperative outcomes 15 years after penetrating keratoplasty. *Am J Ophthalmol* 2005;139:311-9.
- Abu Dail Y, Suffo S, Flockerzi FA, Seitz B. Fibröse retrokorneale und perilentale Membran nach perforierender Keratoplastik [Fibrous retrocorneal and perilenticular membrane after penetrating keratoplasty]. *Ophthalmologie* 2022;119:1054-8.
- Choi JS, Oh JY, Wee WR. A case of corneal endothelial deterioration associated with retained Descemet’s membrane after penetrating keratoplasty. *Jpn J Ophthalmol* 2009;53:653-5.
- Kremer I, Dreznik A, Tessler G, Bahar I. Corneal graft failure following Nd:YAG laser membranotomy for inadvertent retained descemet’s membrane after penetrating keratoplasty. *Ophthalmic Surg Lasers Imaging* 2012;43:e94-8.
- Vengayil S, Vanathi M, Panda A, Khokhar S. Anterior segment OCT-based diagnosis and management of retained Descemet’s membrane following penetrating keratoplasty. *Cont Lens Anterior Eye* 2008;31:161-3.
- Tyring A, Chang O, Jung H. Triamcinolone acetamide-assisted descemetectomy for retained Descemet membrane. *Case Rep Ophthalmol* 2018;9:227-31.
- Tan LT, Au L, Cormack G, Lavin M. Acute glaucoma secondary to angle obstruction by triamcinolone crystals. *Retin Cases Brief Rep* 2009;3:165-6.
- Sinha R, Vajpayee RB, Sharma N, Titiyal JS, Tandon R. Trypan blue assisted descemetorhexis for inadvertently retained Descemet’s membranes after penetrating keratoplasty. *Br J Ophthalmol* 2003;87:654-5.
- Albuainain A, Aldofyan MZ, Otaif W, Al-Muammar A, Alsubki H, Alkatan HM. Successful management of a retained host Descemet’s membrane after penetrating keratoplasty (PKP)-A case report. *Int J Surg Case Rep* 2023;109:108595.
- Chen YP, Lai PC, Chen PY, Lin KK, Hsiao CH. Retained Descemet’s membrane after penetrating keratoplasty. *J Cataract Refract Surg* 2003;29:1842-4.
- Masket S, Tennen DG. Neodymium: YAG laser optical opening for retained Descemet’s membrane after penetrating keratoplasty. *J Cataract Refract Surg* 1996;22:139-41.
- Lifshitz T, Oshry T, Rosenthal G. Retrocorneal membrane after penetrating

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- keratoplasty. *Ophthalmic Surg Lasers* 2001;32:159-61.
18. McVeigh K, Cornish KS, Reddy AR, Vakros G. Retained Descemet's membrane following penetrating keratoplasty for Fuchs' endothelial dystrophy: A case report of a post-operative complication. *Clin Ophthalmol* 2013;7:1511-4.
19. Lazar M, Loewenstein A, Geyer O. Intentional retention of Descemet's membrane during keratoplasty. *Acta Ophthalmol (Copenh)* 1991;69:111-2.
20. Meeraalam Z, Suarez E, Al-Amro M, Vargas JM. Femtosecond laser-assisted membranectomy of retained host's Descemet's membrane postpenetrating keratoplasty. *Middle East Afr J Ophthalmol* 2023;29:167-9.
21. Sharma VK, Raji K, Dhar SK, Agarwal M. Triplet of doubles: Double anterior chamber, double descemet membranes, and double rhexis. *Med J Armed Forces India* 2022;78(Suppl 1):S269-72.
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