

Fibrin glue sealing for repeat Descemet's membrane detachment after deep anterior lamellar keratoplasty: case reports

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Dear Editor,

We report a surgical method for treating repeat Descemet's membrane (DM) detachments in two cases with DM micro-perforation during deep anterior lamellar keratoplasty (DALK). DM micro-perforation is a common intraoperative complication that occurs during the performance of DM baring in DALK, using methods such as the big-bubble air technique^[1]. The sequelae of DM micro-perforations include postoperative DM detachments, higher endothelial cell loss, endothelial decompensation, and transplant interface scarring^[2]. To tamponade the DM micro-perforation, the commonly used approach is intracameral air^[3]. Recently, fibrin glue is emerging as a promising alternative. Fibrin glue is a blood-derived product that is absorbable, relatively easy to use, and can be stored at room temperature or in a refrigerator. It is widely used for small corneal perforation, non-suture DALK, penetrating keratoplasty, and other corneal surgeries^[4]. Here we presented fibrin glue sealing for two cases with repeat DM detachment due to DM micro-perforation in DALK.

The details for successful outcomes are discussed. This study was approved by the Ethical Committee of Zhongshan Ophthalmic Center, Sun Yat-sen University (approval number: 2023KYPJ329), and was conducted in accordance with the principles of the Declaration of Helsinki. Written informed consent was obtained from the two patients.

CASE PRESENTATION

Case 1 A four-year-old boy was diagnosed with herpes simplex keratitis in the right eye six months ago (Figure 1A). On examination, his best-corrected visual acuity (BCVA) was 4/200 in the right eye and 20/20 in the left eye. DALK was planned for his right eye based on evaluation with anterior segment optical coherence tomography (OCT) images.

During removing the corneal stroma, a micro-perforation of the DM occurred at the 5 o'clock position about 2 mm from the corneal limbus. The DALK procedure was successfully accomplished despite the small perforation. The donor cornea was sutured with 16 10-0 nylon suture bites. The anterior chamber was tamponaded with 0.2-mL filtered air. After surgery, DM detachment and the edematous host stroma were noted and then treated with subsequent intracameral air (2wk after the first surgery), 10% perfluoropropane (C₃F₈) gas (4wk after the first surgery), and the combination of intracameral 10% C₃F₈ gas and fibrin glue injection onto the site of perforation through the junction of donor graft and recipient cornea (2mo after the first surgery). However, all the above three treatments were failed, and the double chamber recurred, the lamellar corneal graft became edematous (Figure 1B).

Following a detailed discussion of the surgical procedures and the principles behind fibrin glue formation, we conducted an iridotomy through a scleral incision at the 7 o'clock position to prevent the occurrence of pupil block from C₃F₈ injected into the eye. Subsequently, we performed anterior chamber paracentesis to introduce a small volume of 10% C₃F₈ gas. To expose the DM perforation and ensure it was dry for fibrin glue application, we released nine sutures from the 3 to 9 o'clock positions and used a surgical sponge for drying (Figure 1C). A mixture drop of fibrinogen and thrombin was applied onto the DM micro-perforation. After allowing for

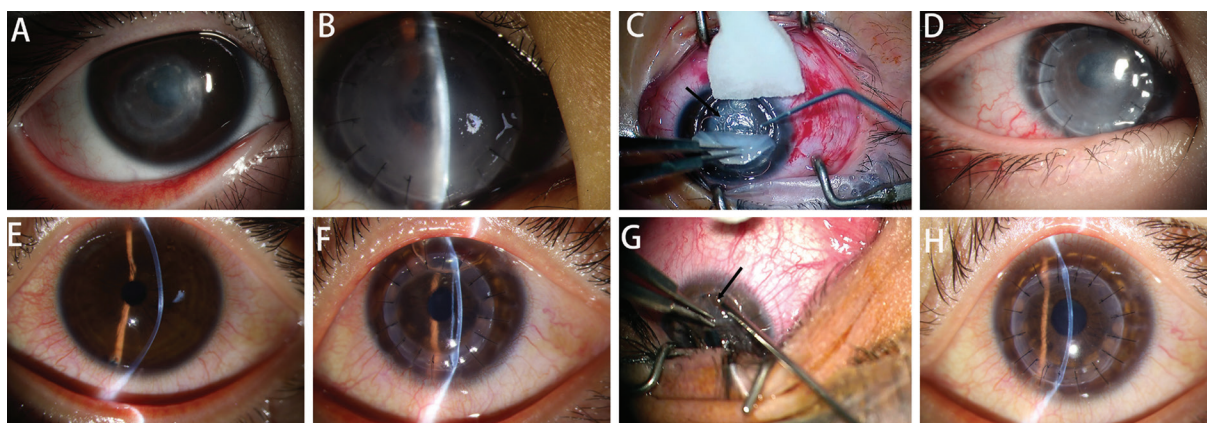


Figure 1 Patients' course of diseases A: A four-year-old boy was diagnosed with herpes simplex keratitis in the right eye; E: A 23-year-old man was diagnosed as keratoconus (the left eye was more serious); B, F: Double anterior chamber recurred after surgery; C, G: In the two cases, the suture was released to expose the DM perforation (black arrow) and make it dry with surgical sponge before fibrin glue application; D, H: The bilateral anterior chamber disappeared and the corneal graft was clear after the application of the fibrin glue. DM: Descemet membrane.

1 to 2min of setting time, the fibrin glue formed a coagulum over the region of application and the excessive mass was trimmed. The donor cornea was sutured back, and then 0.1 mL intracameral 10% C_3F_8 gas was introduced. Postoperatively, the patient was positioned in a face up positions for about a week, taking advantage of the buoyancy of gas in the anterior chamber. In the follow-up, the double chamber had completely disappeared, and the corneal graft was firmly adhered to the transplant bed even after absolution of injected fibrin glue (Figure 1D).

Case 2 A 23-year-old man was diagnosed as keratoconus with BCVA of 20/40 in the right eye and finger counting at 3 m in the left eye (Figure 1E). A conventional big-bubble DALK was performed for his left eye due to intolerance of rigid gas-permeable contact lenses wearing. During the surgery, a micro-perforation from the trephination margin occurred at the 7 o'clock position and was tamponaded by an intracameral filtered air.

Five days after surgery, a slit perforation was observed at the inferior edge of transplant bed, and a liquid space was formed between the graft and host DM. In the following month, three attempts at anterior chamber air injection were made, all of which were unsuccessful. The fourth attempt to resolve the double anterior chamber (Figure 1F) was application of an intracameral 10% C_3F_8 gas and fibrin glue which was injected through the space between suture bites. However, 5d later, it was failed. Finally, anterior chamber paracentesis was done, and 0.2 mL 10% C_3F_8 gas was injected into the anterior chamber, three sutures from the 6 to 8 o'clock position were released to expose the slit DM perforation, fibrin glue was used to form a gel, and the graft was sutured again (Figure 1G). Postoperatively, the patient was positioned in a face up position for a week.

On the first postoperative day after the second trial, no double

anterior chamber formation occurred, and there was no interface inflammation or infiltration in the interface between the graft and recipient cornea. The graft remained clear throughout the follow-up (Figure 1H). The patient's BCVA was 20/60 at 1mo, and 20/40 at 6mo.

DISCUSSION

DM micro-perforation is one of the most challenging complications during and after DALK. In a large series report, intraoperative DM perforations were reported at a rate of 18.7% in DALK. Among them, 38.6% cases developed DM detachments on the first postoperative day^[3]. Extensive DM detachments may create a double anterior chamber appearance. Corneal edema will be resolved after a rapid reattachment of the DM detachments. However, corneal endothelial dysfunction may happen if the DM detachments lasts^[5].

Management of the DM perforation includes intracameral air tamponade, stromal patching, suturing of the defect, and their combination. One or multiple air or gas intraocular tamponade was usually the first management for treating a small perforation. However, this was not always effective like in these two cases of this study. It depends on the location of DM because the floating of air is hard to tamponade the inferior DM in the postoperative days.

Fibrin glue is a biological tissue adhesive that imitates the final stages of the coagulation cascade. The fibrin clot will degrade within 1-2wk. Por *et al*^[6] reported a technique of intracameral injection of fibrin glue during therapeutic DALK in one patient. It is difficult to form fibrin clotting between DM and intracameral air, and to maintain a stable air tamponade at the same time. For peripheral DM, a stromal patch was introduced onto the DM and then fibrin glue was used for sealing^[7].

In the two cases of this report, fibrin glue was first injected into the interface of corneal transplant for sealing the DM with corneal sutures *in situ* but failed. Considering an aqueous

humor and slit space between the graft and recipient corneas may interfere with the fibrin glue clotting which requires a completely dry environment^[8], some sutures were release and then fibrin was applied onto the exposed DM after drying. When the glue clotting formed, the released sutures were refixed and a gas of 10% C₃F₈ was injected into the intraocular chamber for tamponade. The good results verified the effect of this modified application of fibrin glue. During the follow-up, any toxic or allergic reactions to fibrin glue were not noted. In conclusion, the described technique in this study provided an effective alternative for sealing DM after DALK, especially for a repeated double anterior chamber formation. The key point for successful application of fibrin glue for sealing a DM needs a dry bed before fibrin clotting on the corneal interface.

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