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Case report

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Descemet stripping only and ripasudil for the treatment of traumatic Descemet's membrane ruptures

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Abstract

Purpose: Descemet´s membrane ruptures (with a discontinuation of Descemet´s membrane and double detached coiled edges) in the context of complicated anterior segment surgery have rarely been described and its management can be challenging. We report a modified Descemet stripping only (DSO) technique associated with ripasudil drops to treat these cases when other techniques fail.

Methods: We describe two cases of large Descemet´s membrane detachments associated with Descemet´s ruptures after cataract surgery that did not respond to two SF_6 intracameral injections. As the detached Descemet's membrane and coiled edges might have prevented endothelial cell migration, we decided to perform a modified DSO with post-operative ripasudil drops to promote corneal clearance.

Results: Both cases improved significantly in unaided and best corrected visual acuity (BCVA), corneal clearance and pachymetry, avoiding the need for an endothelial keratoplasty. Endothelial cells were observed on specular microscopy within the area of the descemetorhexis.

Conclusion: DSO with ripasudil drops might be a valuable tool to recover corneal clearance and avoid endothelial keratoplasty in complex Descemet´s membrane detachments with ruptures that do not respond to other treatments.

Keywords

descemetorhexis without endotelial keratoplasty, descemet stripping only, ripasudil, ROCK inhibitors, descemet´s membrane detachment

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Introduction

Descemet's membrane detachment (DMD) is a potential vision-threatening complication, being reported in 0.5% of the cases after phacoemulsification.[1–3] Most DMDs are peripheral, non-significant and resolve spontaneously within days or weeks after surgery without causing any visual compromise. Large and central DMDs, if not managed appropriately, may lead to chronic corneal oedema and opacification. Descemetopexy with air or gas is usually the standard treatment. Descemet´s membrane rupture (with a discontinuation of Descemet´s membrane and double detached edges), however, has rarely been described. Its management can be more challenging with the risk of attaching one of the edges but further detaching the other edge with a standard descemetopexy.

Descemet stripping only (DSO) has gained popularity in the past years to treat mild cases of Fuchs dystrophy

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with a good peripheral cell count, avoiding the need of an endothelial keratoplasty.[4–6] Typically, a central 4mm descemetorhexis is performed to eliminate the diseased endothelium and guttae, allowing healthier peripheral endothelial cells to repopulate that area. It can also be treated with additional topical Rho-associated kinase (ROCK) inhibitor drops to speed endothelial cell migration and aid corneal clearance, improving the outcomes.[5,7] We hypothesized that DSO may be successful in cases with Descemet´s membrane ruptures that do not respond to other treatments. We present two cases with traumatic Descemet´s membrane ruptures after complicated cataract surgery that did not respond to multiple intracameral injections of SF_6 gas and were treated with DSO and ripasudil drops (0.4%, Glanatec). Both patients provided written informed consent for their information and images to be published.

Case description

Case 1

A 75-year-old patient underwent cataract surgery, which required intraocular lens exchange due to a broken haptic. There was inadvertent Descemet´s membrane touch leading to a focal breach, and air tamponade was left at the end of the procedure. Postoperatively, a central Descemet's membrane rupture and detachment were seen in the anterior segment optical coherence tomography (AS-OCT CASIA 2, Tomey) affecting the visual axis and paracentral superior cornea. Two injections of intracameral SF_6 20% three days and seven days after the primary surgery failed to reattach Descemet's membrane and clear the cornea. One month after surgery, the corneal apex pachymetry was 1012 µm and best corrected visual acuity (BCVA) was 20/400. A trial of ripasudil drops (0.4%, Glanatec) were prescribed six times a day for 2 weeks with no improvement. As the coiled edges of Descemet´s membrane may have prevented endothelial cell migration and peripheral endothelial cell density was presumed to be normal (preoperative central endothelial cell density was 2184 cells/mm2), we decided to perform a modified DSO. With the use of trypan blue (Vision Blue®, DORC) to aid visualization we removed the detached coiled Descemet's membrane (approximately 4mm) with retinal forceps and continued ripasudil four times a day for one month, three times a day for two weeks and twice a day for two weeks. The patient also received treatment with topical prednisolone acetate 1% (Predforte®, Allergan) four times a day for two weeks followed by a tapering dose for three months and hypertonic 5% sodium chloride drops (Colircusí Antiedema, Novartis) three times a day for three months. During the follow-up period, the Descemet´s membrane was attached and there was a progressive improvement in corneal pachymetry and corneal clearance. Two months after DSO, BCVA improved to 20/25 (20/30 unaided) and corneal apex pachymetry was 713 µm despite a superior area of mild honeycomb corneal edema. One week after stopping ripasudil, the visual acuity decreased slightly to 20/32 and the small area of corneal edema persisted. After observing for two more weeks ripasudil four times a day was recommenced. Two weeks later, the BCVA improved to 20/21, corneal apex pachymetry decreased to 595 µm and the honeycomb edema had reduced. We decreased ripasudil to twice a day for 1 month and was then discontinued. At the last follow-up, eight months after stopping ripasudil (one year after DSO) BCVA remains stable at 20/21 (UCVA 20/25), corneal apex pachymetry is 580 µm and the cornea is clear. Endothelial cells could be seen on specular microscopy within the area of the descemetorhexis three months after DSO (Figure 1) and the cell density at the area of the DSO was of 843 cells/mm^2 at the last follow up, one year after the DSO (Figure 3).

Case 2

Phacoemulsification was performed in a 76 year-old patient, which was complicated with posterior capsular rupture and inadvertent Descemet´s membrane touch. During phacoemulsification an undulating DMD involving the central and temporal cornea was observed, as well as a possible central area of Descemet's membrane loss. Air tamponade was maintained at the end of the surgery. During the postoperative course a Descemet´s membrane rupture could be seen on AS-OCT (CASIA 2, Tomey) with an associated detachment affecting the visual axis and temporal cornea. We attempted to re-attach the DMD with two intracameral injections of SF_6 20% three days and eleven days after the primary surgery. In the second rebubbling, Descemet´s membrane was observed to fold over itself and an area of Descemet's membrane loss was suspected. An attempt to reposition DM was performed with trypan blue (Vision Blue®, DORC) and cannula maneuvers similar to a DMEK surgery, leaving a bubble of SF_6 20%. Despite this surgery, the DMD didn't improve and corneal edema persisted. Central endothelial cell density was normal (2125 cells/mm^2) before phacoemulsification, so we decided to perform a DSO, as described in case 1, leaving an area of bare stroma of 5mm. Ripasudil was started six times a day for one month, followed by twice a day for one month. The patient also received treatment with topical prednisolone acetate 1% (Predforte®, Allergan) four times a day for two weeks followed by a tapering dose for two months and hypertonic 5% sodium chloride drops (Colircusí Antiedema, Novartis) three times a day for two months. Three weeks after DSO, BCVA improved from 20/1000 to 20/63 and corneal apex pachymetry decreased from 790 µm to 641 µm. Two months after surgery BCVA improved to 20/30 (UCVA 20/50), corneal apex pachymetry decreased to 531 µm and endothelial

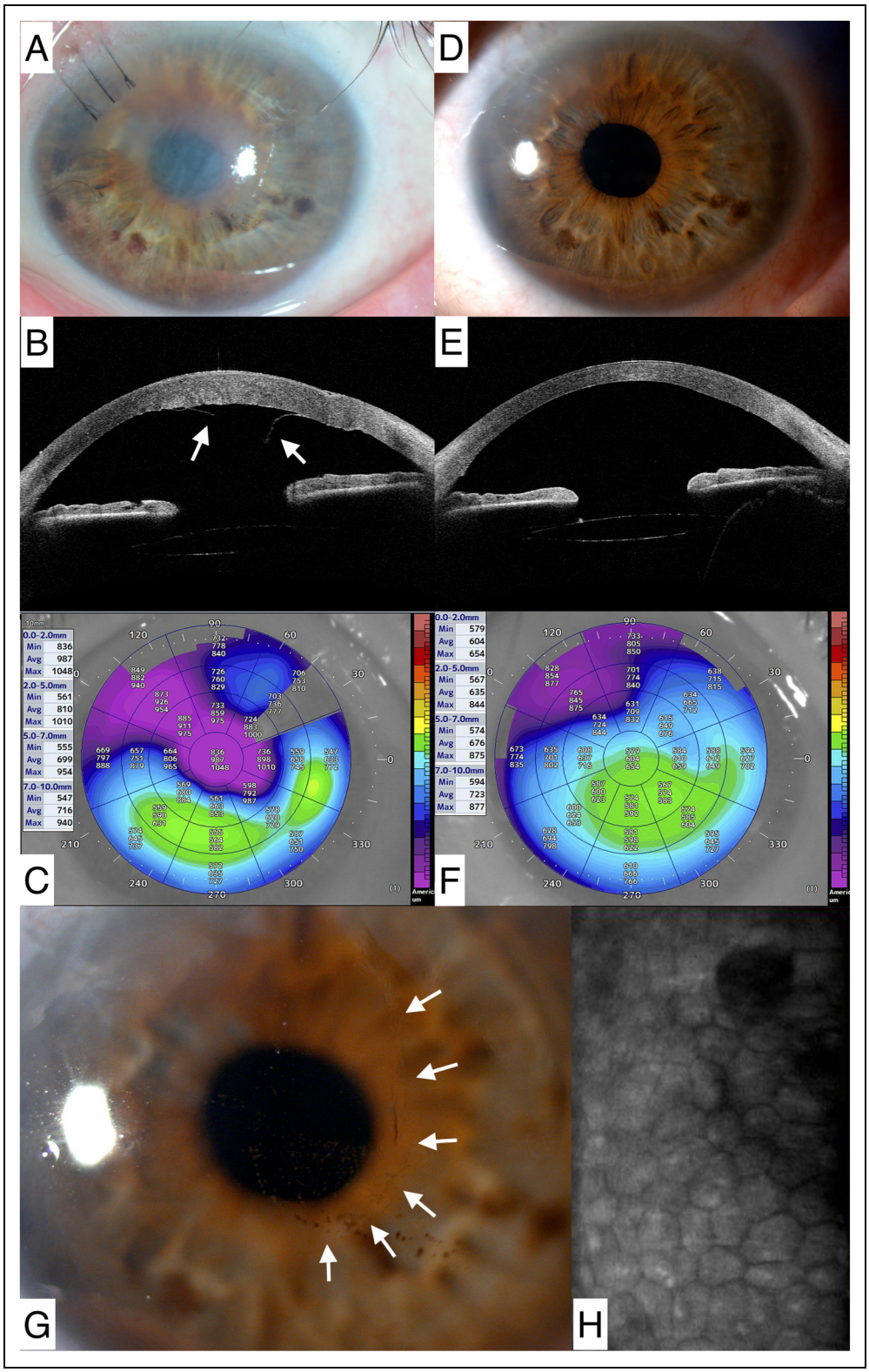

Figure 1. Case 1. A, Pre-operative slit-lamp photograph depicting persistent central corneal edema after cataract surgery, despite two intracameral SF_6 injections. B, Anterior segment OCT after the intracameral SF_6 demonstrating a central traumatic rupture of Descemet's membrane causing a detachment with coiled edges (arrows). C, Pachymetry map with central corneal edema. D-F, Post-operative slit-lamp photograph, anterior segment OCT and pachymetry map six months after DSO and ripasudil showing a clear cornea with resolution of the edema, no Descemet detachments and decreased corneal pachymetry. G, Slit-lamp photograph depicting the limit of the descemetorhexis (arrows) with a clear cornea despite the bare stroma. H, Central specular microscopy image three months after DSO showing endothelial cells within the DSO area.

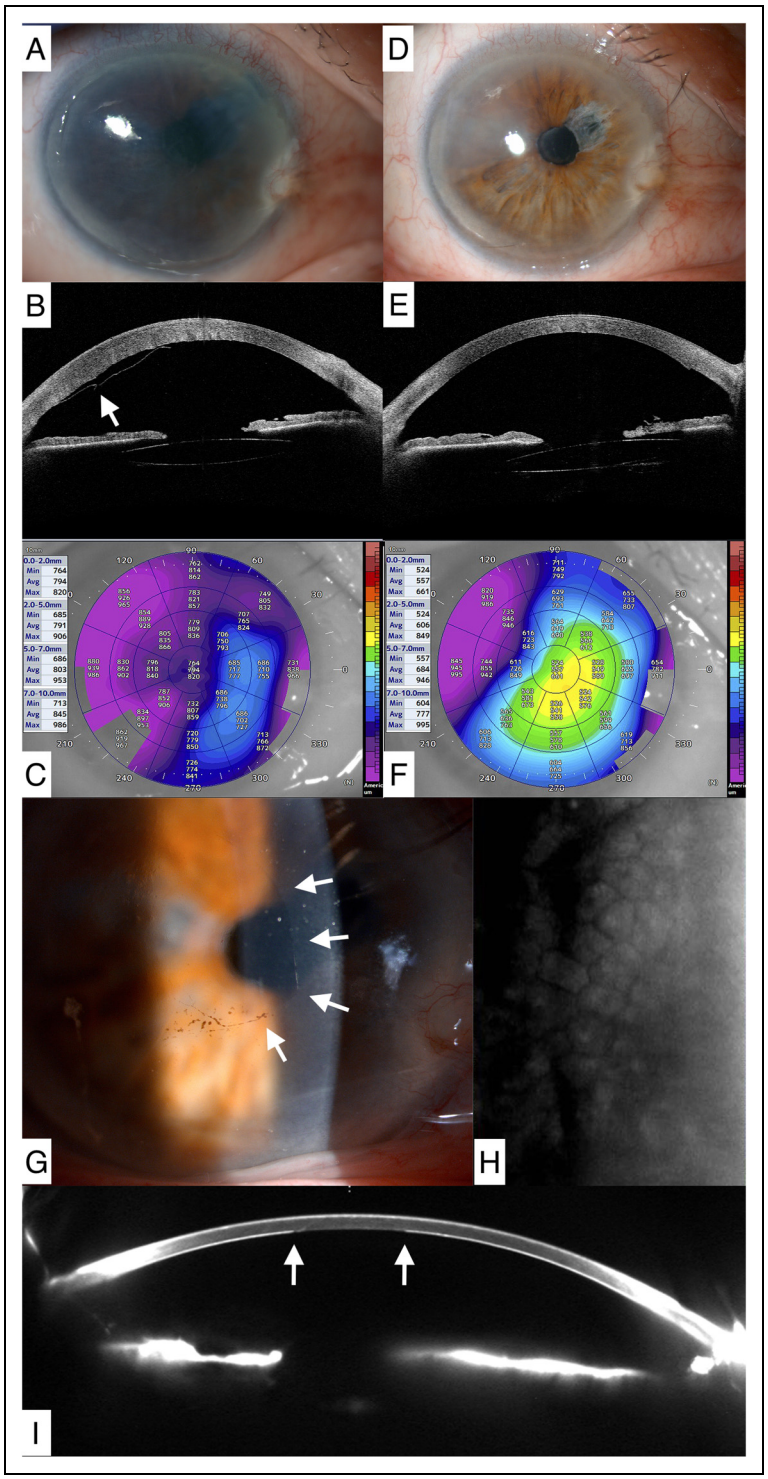

Figure 2. Case 2. A, Pre-operative picture showing a diffuse corneal edema. B, Anterior segment OCT demonstrating an area of Descemet´s membrane rupture (arrow) and detachment from the temporal to central cornea. C, Pachymetry map with increased corneal thickness more pronounced in the temporal cornea. D-F, Post-operative slit-lamp picture, anterior segment OCT and pachymetry map five months after DSO showing a central clear cornea and decreased pachymetry with only mild residual corneal edema in the temporal cornea. G, Slit-lamp photograph demonstrating the edge of the descemetorhexis (arrows) and adjacent clear cornea. H, central specular microscopy image two months after DSO showing endothelial cells within the descemetorhexis area. I, Scheimpflug image depicting the area of bare stroma (arrows).

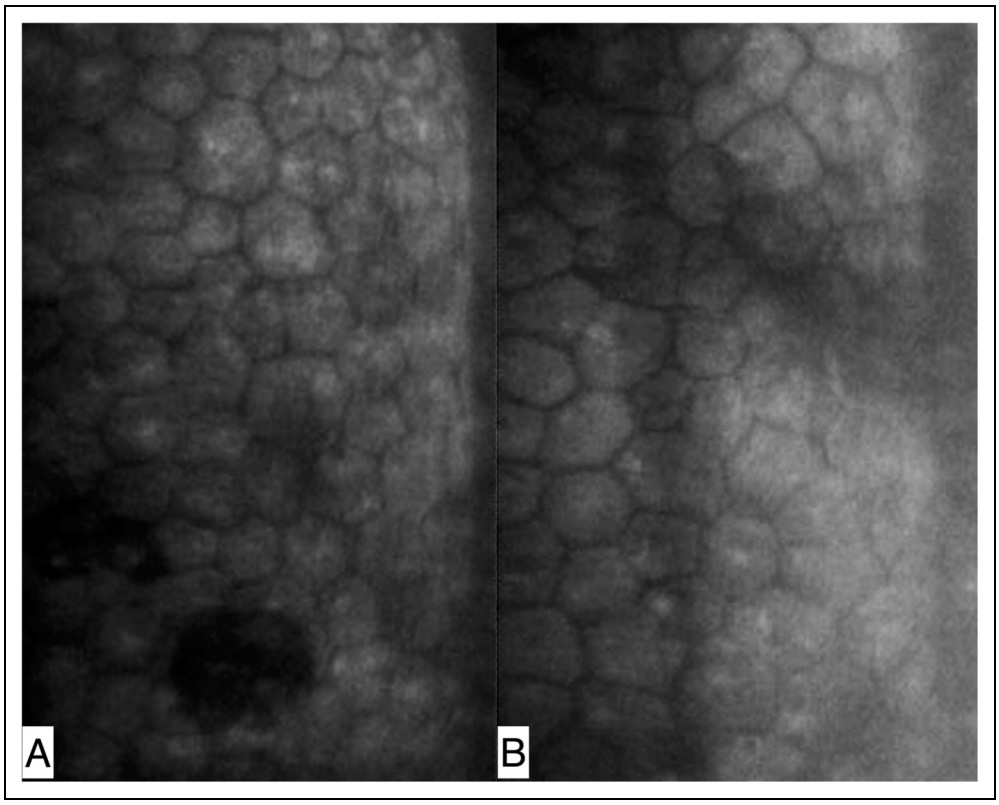

Figure 3. Specular microscopy images showing the endothelial cells at the area of the DSO at the last follow-up visit, one year after DSO in case 1 (A) and ten months after DSO in case 2 (B).

cells could be seen by specular microscopy in the denuded area. Although the visual axis was clear there was some persistent temporal corneal edema so we decided to continue ripasudil four times a day. One month later there were no significant changes in corneal pachymetry or visual acuity and despite some persistent temporal edema the patient was happy with his vision and we decided to decrease ripasudil to twice a day two more weeks with a plan to discontinue thereafter, although the patient continued ripasudil twice a day for an additional four weeks. At the last follow-up, ten months after DSO (six months after stopping ripasudil), BCVA was 20/25 (UCVA 20/32) and corneal apex pachymetry was 531 μm. The endothelial cell density at the area of the DSO is 591 cells/mm^2 (Figure 3), and there is still a mild corneal edema in the temporal cornea but the visual axis is clear and the patient is satisfied, having even better vision than in the fellow eye. (Figure 2).

Discussion

Small, peripheral planar DMD following intraocular surgery with non-scrolled edges may reattach spontaneously. Cases with non-planar, central DMD, scrolled edges and more than 2mm of length usually need to be managed surgically.[1] Early surgical intervention for detachments involving the central cornea leads to a better visual prognosis because the presence of DMDs and resultant corneal oedema for prolonged periods can result in fibrosis and scarring of DM, affecting visual recovery. Descemetopexy with air or gas is usually the standard treatment. Other management options that have been described include mechanical tamponade with viscoelastic or perfluorocarbons, suture fixation, descemetotomy, interface drainage and finally keratoplasty if all of the previous treatments are unsuccessful.[1,3]

Descemet´s membrane ruptures with two coiled edges in the context of complicated anterior segment surgery are more challenging to treat and there is scarce information on the outcomes of treatment in the literature. A recent study in post-cataract surgery DMDs including 112 eyes reported that 7.3% of the anatomical failures with descemetopexy had either a large DM tear or DM loss leading to persistent corneal oedema and corneal decompensation, and were managed with an endothelial keratoplasty.[2] While air or gas tamponade may be sufficient, there is a higher risk of detaching one of the edges, if there are two free edges associated with the DMD. Manual repositioning of the detached edges with various instruments or intracameral viscoelatic injection could be successful in these cases but are associated with a higher risk of increasing intraocular pressure or damaging the

endothelium.[8] Suture fixation would cause astigmatism. DMEK unfolding techniques can be mimicked, but are not straightforward. Intraoperative OCT might be helpful for these maneuvers to visualize the DMD, allowing identification of the correct plane and assess its reattachment at the end of the procedure, but the technology is not readily available due to its cost. In recalcitrant DMDs where other treatments have failed, endothelial keratoplasty is usually the next step. However our cases demonstrate that DSO with ripasudil may be an alternate option to remove the persistent detached Descemet after descemetopexy and allow peripheral endothelial cell migration.

DSO has mainly been reported to successfully treat early cases of central Fuchs' endothelial dystrophy with a good peripheral endothelial cell density.[4–6] Although the outcomes can be variable, good results with DSO have been reported in some cases up to five years follow up.[6] ROCK inhibitor drops are usually associated with DSO to improve its outcomes[7] and have also been used in some isolated case reports for other forms of endothelial dysfunction with variable outcomes.[9] There is one reported case of DSO and netarsudil in a chronic Descemet´s membrane detachment in a patient with Fuchs' endothelial dystrophy.[10] It has not previously been reported as a treatment for traumatic Descemet's membrane rupture in otherwise normal corneas. Our cases had good endothelial cell densities before surgery, and although some endothelial cells would have been damaged during phacoemulsification, we hypothesized that if we performed a DSO in these cases to eliminate the detached Descemet's membrane, there would be sufficient endothelial cells to repopulate the central bare area and clear the cornea, avoiding the need of an endothelial keratoplasty. We performed the smallest descemetorhexis required (4–5mm) to only remove the detached Descemet's membrane. We decided to add ripasudil to enhance corneal endothelial wound healing after DSO in these atypical cases as it has been reported it speeds corneal clearance enabling a more rapid visual recovery and higher endothelial cell density.[7]

Our two cases had a successful outcome, avoiding the need of an endothelial keratoplasty. In both cases endothelial cells could be seen in the area of bare stroma, confirming the migration and/or proliferation of the peripheral endothelial cells. The first case achieved complete corneal clearance. The second case has a small persistent area of focal non-clearance in the temporal cornea, which might be explained by a more eccentric DSO, an additional area of Descemet loss during phacoemulsification and higher endothelial cell trauma or a larger descemetorhexis size. Fortunately, this is not visually significant and the patient is happy with the outcome, without requiring an endothelial keratoplasty so far. A larger case series as well as a longer follow-up is required to evaluate whether relapse of edema will occur in these cases and the best ripasudil dose is yet to be optimized. We decided to start with a dose of six times a day based on the DSO study by Moloney et al.,[5] followed by twice a day for one more month but the dose was adjusted during the follow up due to areas of non-clearance.

In conclusion, DSO associated with ripasudil drops might be a valuable tool to recover corneal clearance and visual acuity after traumatic Descemet´s membrane ruptures that do not respond to other surgeries, avoiding the need for an endothelial keratoplasty. Further studies with larger samples sizes are necessary to confirm these outcomes.

Declaration of conflicting interests

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