



# Intracameral Sulfur Hexafluoride Gas Injection and Descemet Membrane Endothelial Keratoplasty for Treatment of Descemet Membrane Detachment After Phacoemulsification Surgery

## Fakoemülsifikasyon Cerrahisi Sonrası Desme Membranı Dekolmanı Tedavisinde Intrakameral Sülfür Hekzaflorür ve Desme Membran Endotelial Keratoplasti Uygulaması

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### ABSTRACT

The aim of this study is to present a case series of 4 patients with Descemet membrane detachment after cataract surgery. Reattachment was achieved in 3 of 4 cases (75%) with a single intracameral sulfur hexafluoride injection. Case 4 had a long-term Descemet membrane detachment that was adherent to other anterior segment structures and thus unresponsive to repetitive intracameral gas injections. Therefore, a successful Descemet membrane endothelial keratoplasty was performed on this patient. A 10% sulfur hexafluoride injection seems to be a safe and effective method for uncomplicated Descemet membrane detachment; however, Descemet membrane endothelial keratoplasty surgery should be favored in complicated cases unresponsive to intracameral injections.

**Keywords:** Descemet membrane detachment, Descemet membrane endothelial keratoplasty, intracameral SF6 treatment, phacoemulsification surgery

### ÖZ

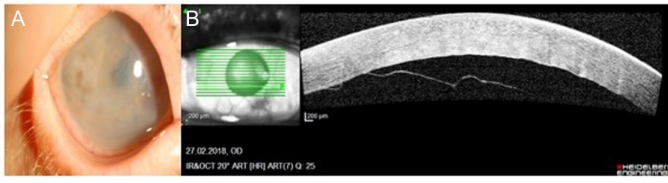
Bu çalışmanın amacı, katarakt cerrahisi sonrası Desme membranı dekolmanı gelişen 4 hastadan oluşan bir vaka serisi sunmaktır. 4 vakanın 3'ünde (%75) tek doz intrakameral sülfür hekzaflorür enjeksiyonu ile yeniden yapışma sağlanmıştır. Olgu 4'te diğer ön segment yapılarına yapışmış ve bu nedenle tekrarlayan intrakameral gaz enjeksiyonlarına yanıt vermeyen uzun süreli Desme membranı dekolmanı vardı. Bu nedenle bu hastaya başarılı bir şekilde Desme membran endotelial keratoplasti cerrahisi uygulanmıştır. %10 sülfür hekzaflorür enjeksiyonu, komplike olmayan Desme membranı dekolmanı için güvenli ve etkili bir yöntem gibi görünmektedir; ancak intrakameral enjeksiyonlara yanıt vermeyen komplike olgularda Desme membran endotelial keratoplasti ameliyatı tercih edilmelidir.

**Anahtar Kelimeler:** Desme membranı dekolmanı, Desme membran endotelial keratoplasti, intrakameral SF6 tedavisi, fakoemülsifikasyon cerrahisi

### INTRODUCTION

Descemet membrane detachment (DMD) can result in the loss of endothelial pump function, leading to corneal edema, reversible and irreversible bullous keratopathy (in case of delay or insufficient treatment), and eventual deep vision loss.<sup>1,2</sup>

Most detachments located at the incision site tend to be small and heal spontaneously.<sup>2</sup> However, large detachments may cause significant vision loss.<sup>3</sup> Early diagnosis and commencing proper treatment timely are vital to prevent vision loss. In cases unresponsive to medical treatment, and affecting the central cornea, intracameral air or gas injection should be considered as a primary therapeutic option.<sup>3</sup>



**Figure 1.** Corneal edema and a large oval tear in the central cornea where Descemet's membrane was detached in the right eye. A wide Descemet detachment line was observed in the anterior segment optical coherence tomography.

Herein, we aimed to describe 4 cases of DMD after cataract surgery and appropriate surgical management for them.

## CASE PRESENTATIONS

### Case 1

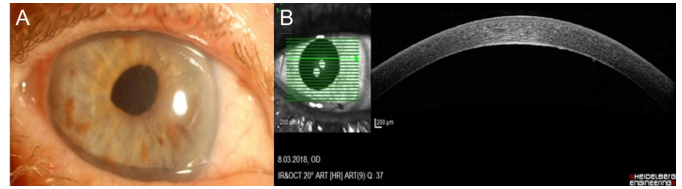
A 76-year-old female patient was referred to our clinic with a history of vision loss in the right eye (RE) after phacoemulsification surgery performed 3 weeks ago. Best-corrected visual acuity (BCVA) of the RE was counting fingers (CF) from 4 m. Anterior segment examination of the RE revealed corneal edema and a large oval tear in the central cornea where DMD exists. A wide DMD line was observed in the anterior segment optical coherence tomography (Figure 1). Afterward, 10% sulfur hexafluoride (SF6) was injected into the anterior chamber and then the patient was kept in supine position. On the 10th day following gas injection, Descemet's membrane was re-attached, the cornea became completely transparent, and BCVA increased to 20/40 (Figure 2).

### Case 2

A 74-year-old female patient was admitted to our clinic with the complaint of low vision in the RE after cataract surgery. On biomicroscopy, RE was pre-phthisic with no light perception due to fungal endophthalmitis. The BCVA of the left eye was counting fingers from 5 m and grade 3-4 nuclear cataract was observed. Phacoemulsification with intraocular lens (IOL) implantation surgery was performed. During the intraoperative IOL implantation, some air

## MAIN POINTS

- There is no gold standard for the treatment of Descemet membrane detachment (DMD). In the last decades, a great number of medical and surgical options have been introduced to treat DMD.
- A 10% sulfur hexafluoride gas injection seems to be a safe and effective method in patients with Descemet detachment that occurred after cataract surgery.
- Scheimpflug topography may provide valuable information about the deep DMD whose borders cannot be visualized by anterior segment optical coherence tomography imaging.

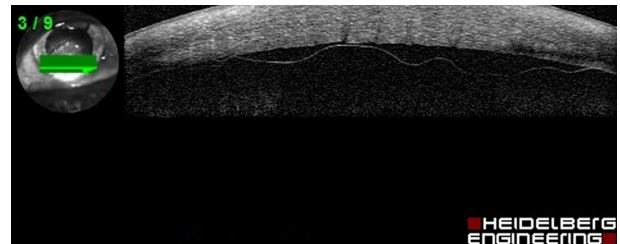


**Figure 2.** At the 10th day after gas injection, Descemet's membrane was re-attached; the cornea was transparent, and visual acuity increased to 20/40. Slit-lamp photograph (left) and anterior segment optical coherence tomography (right).

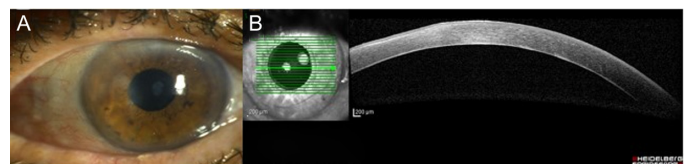
bubbles inadvertently migrated between the Descemet's membrane and corneal stroma. After the removal of viscoelastic material, the Descemet detachment was still present without air bubble. The surgery was completed by the injection of air into the anterior chamber. Because of the recurrence of DMD with accompanying corneal edema after the resorption of intracameral air (Figure 3), 10% SF6 was given to the anterior chamber twice on postoperative days 3 and 6. The patient's BCVA was 20/40 at postoperative second week and complete Descemet membrane attachment and cornea transparency were achieved (Figure 4).

### Case 3

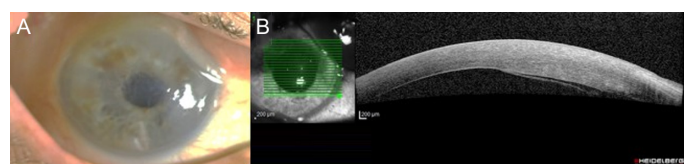
An 84-year-old male patient was referred to our clinic with corneal edema in the RE persisting for 1 week



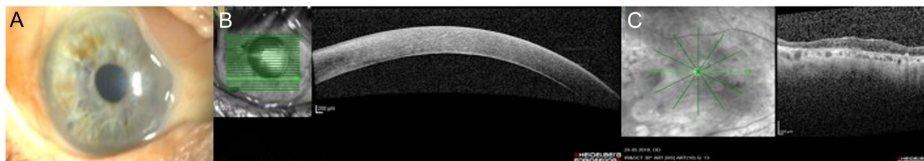
**Figure 3.** Corneal edema after resorption of intracameral air in the left eye anterior segment optical coherence tomography.



**Figure 4.** Complete Descemet attachment and cornea transparency were achieved, Slit-lamp photograph (left) and anterior segment optical coherence tomography (right).



**Figure 5.** Severe corneal edema was observed in the right eye. Descemet membrane detachment with tear in the anterior segment optical coherence tomography.



**Figure 6.** Corneal transparency together with complete Descemet membrane attachment. Slit-lamp photograph (left) and anterior segment optical coherence tomography (right).



**Figure 7.** Descemet membrane detachment, In the anterior segment optical coherence tomography, Descemet membrane detachment was observed, but borders were indiscernible. In the anterior segment imaging with Scheimpflug topography, the Descemet's membrane was seen to be fragmented and adherent to the iris.

after cataract surgery done by another clinic. On ocular examination, his visual acuity in the RE was at hand motion level and severe corneal edema was observed (Figure 5). Anterior segment optical coherence tomography revealed DMD with inferior Descemet tear (Figure 5). On the seventh day after 10% SF6 injection, the visual acuity improved to counting fingers from 1 m and corneal transparency was achieved together with complete Descemet's membrane attachment (Figure 6). The low final visual acuity was attributed to the wide geographic macular atrophy (Figure 6).

#### Case 4

A 77-year-old female patient was referred to our clinic with a diagnosis of DMD after cataract surgery carried out 20 days ago. The visual acuity was at hand motion level, and severe corneal edema and large DMD were observed on biomicroscopic examination (Figure 7). On AS-OCT imaging, DMD was observed (Figure 7), but the detachment borders were indiscernible. On Scheimpflug topography, the Descemet's membrane was fragmented and firmly adherent to the iris (Figure 7). Because of the failure in reattaching Descemet membrane with 10% SF6 gas injection applied 2 times at a 3-day interval and no improvement observed in corneal edema, Descemet membrane endothelial keratoplasty (DMEK) was performed. The final visual acuity was 0.7, and the cornea was

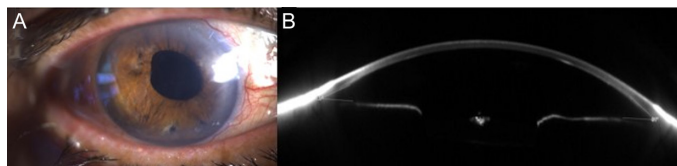
transparent with centered graft at postoperative second week (Figure 8).

#### DISCUSSION

Descemet membrane detachment after cataract surgery is a rare but serious complication. Early surgical intervention could be a better approach, especially in cases with the involvement of the central cornea and pupillary axis.<sup>4</sup> As a surgical treatment, intracameral air, 10-20% SF6, and 12-14% perfluoropropane injection were reported in the literature.<sup>5,6</sup> A 10% SF6 was used in all of our cases.

Penetrating keratoplasty,<sup>1</sup> DMEK,<sup>6</sup> and Descemet-stripping automated endothelial keratoplasty<sup>7</sup> may be considered as further surgical options for advanced Descemet detachments where long-term, persistent DMD with severe corneal edema, scarring. In our study, case 4 had a long-term DMD that was adherent to other anterior segment structures and did not respond to repetitive intracameral gas injections. Therefore, we performed DMEK surgery on this patient.

The AS-OCT is a very useful tool for both the diagnosis and classification of DMD and is now considered the gold standard diagnostic method.<sup>8</sup> Moutsouris et al<sup>9</sup> showed that AS-OCT provided sufficient visualization of corneal graft in cases of early graft detachment after DMEK and contributed to the planning of further treatment. In contrast, Scheimpflug imaging cannot allow better visualization than slit-lamp biomicroscope because of light scattering in edematous corneas, whereas AS-OCT, using interferometry, allows the best visualization of corneal microstructures in detail in optical scattering media, for example, edematous corneas. In our study, on AS-OCT imaging of case 4, DMD was observed, but detachment



**Figure 8.** The cornea was transparent with graft in place. Slit-lamp photograph (left) and the anterior segment imaging with Scheimpflug topography (right).

borders could not be discernible. Therefore, with the help of anterior segment imaging with Scheimpflug topography, Descemet's membrane was seen to be fragmented and adherent to the iris.

In conclusion, 10% SF6 injection seems to be a safe and effective method in patients with DMD after cataract surgery. Scheimpflug topography may provide valuable information on the deep DMD whose borders cannot be visualized on AS-OCT imaging. Adhesion of the Descemet membrane to the other anterior segment structures is an important prognostic factor affecting the success of intracameral gas injections. DMEK surgery could be an effective surgical method in cases unresponsive to intracameral gas injections.

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## REFERENCES

1. Marcon AS, Rapuano CJ, Jones MR, Laibson PR, Cohen EJ. Descemet's membrane detachment after cataract surgery: management and outcome. *Ophthalmology*. 2002;109(12):2325-2330. [\[CrossRef\]](#)
2. Patel DV, Phang KL, Grupcheva CN, Best SJ, McGhee CNJ. Surgical detachment of Descemet's membrane and endothelium imaged over time by in vivo confocal microscopy. *Clin Exp Ophthalmol*. 2004;32(5):539-542. [\[CrossRef\]](#)
3. Mahmood MA, Teichmann KD, Tomey KF, Al-Rashed D. Detachment of Descemet's membrane. *J Cataract Refract Surg*. 1998;24(6):827-833. [\[CrossRef\]](#)
4. Saeed MU, Singh AJ, Morrell AJ. Sequential Descemet's membrane detachments and intraocular lens haze secondary to SF6 or C3F8. *Eur J Ophthalmol*. 2006;16(5):758-760. [\[CrossRef\]](#)
5. Landry H, Aminian A, Hoffart L, et al. Corneal endothelial toxicity of air and SF6. *Invest Ophthalmol Vis Sci*. 2011;52(5):2279-2286. [\[CrossRef\]](#)
6. Jacob S, Agarwal A, Chaudhry P, Narasimhan S, Chaudhry VN. A new clinico-tomographic classification and management algorithm for Descemet's membrane detachment. *Cont Lens Anterior Eye*. 2015;38(5):327-333. [\[CrossRef\]](#)
7. Kim JJ, Kim HK. Descemet membrane stripping endothelial keratoplasty for Descemet membrane detachment following phacoemulsification. *Can J Ophthalmol*. 2015;50(1):73-76. [\[CrossRef\]](#)
8. Kumar DA, Agarwal A, Sivanganam S, Chandrasekar R. Height-, extent-, length-, and pupil-based (HELP) algorithm to manage postphacoemulsification Descemet membrane detachment. *J Cataract Refract Surg*. 2015;41(9):1945-1953. [\[CrossRef\]](#)
9. Moutsouris K, Dapena I, Ham L, Balachandran C, Oellerich S, Melles GR. Optical coherence tomography, Scheimpflug imaging, and slit-lamp biomicroscopy in the early detection of graft detachment After Descemet membrane endothelial keratoplasty. *Cornea*. 2011;30(12):1369-1375. [\[CrossRef\]](#)