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ORIGINAL ARTICLE

Descemet membrane endothelial keratoplasty in multifocal pseudophakic eyes

Ceratoplastia endotelial da membrana de Descemet em olhos pseudofácicos multifocais

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ABSTRACT | Purpose: This report describes the use of Descemet membrane endothelial keratoplasty for the management of endothelial decompensation after multifocal intraocular lens implantation. **Methods:** In this retrospective study, we reviewed and assessed the surgical outcomes of 9 patients (9 eyes) who underwent Descemet membrane endothelial keratoplasty after multifocal intraocular lens implantation. **Results:** Corneal edema occurred due to Fuchs endothelial corneal dystrophy (n=3), pseudophakic bullous keratopathy (n=3), Descemet's membrane detachment (n=2), and toxic anterior segment syndrome (n=1). The Descemet membrane endothelial keratoplasty surgeries were uneventful in all eyes, but rebubbling procedures were necessary in 2 eyes. One month after the surgery, all the corneas were clear. After 6 months, excluding 1 eye with amblyopia, the mean distance corrected visual acuity was 0.10 logMAR, with all eyes achieving 0.18 logMAR or better. **Conclusions:** This is the first report of Descemet membrane endothelial keratoplasty after multifocal intraocular lens implantation, and it suggests that good results can be achieved without multifocal intraocular lens exchange.

Keywords: Descemet membrane; Descemet membrane endothelial keratoplasty; Fuchs endothelial dystrophy; Corneal transplantation; Intraocular lens implants

RESUMO | Objetivo: Descrever o uso da ceratoplastia endotelial da membrana de Descemet para manejar descompensação endotelial após implante de lente intraocular multifocal. **Métodos:** Neste estudo retrospectivo, foram revisados e avaliados os resultados cirúrgicos de 9 olhos de 9 pacientes que foram submetidos a ceratoplastia endotelial da membrana de Descemet para manejar descompensação endotelial após implante de lente intraocular multifocal. **Resultados:** Descompensação endotelial ocorreu por distrofia endotelial de Fuchs (n=3), ceratopatia bolhosa do pseudofácico (n=3), descolamento da membrana de Descemet (n=2) e síndrome tóxica do segmento anterior (n=1). No ato per operatório de todos os olhos não houve intercorrência, com injeção de ar sendo necessário em dois olhos no pós-operatório por descolamento parcial do enxerto. Um mês após a cirurgia, todas as córneas estavam claras. Após seis meses, excluindo um olho com ambliopia, a acuidade visual média corrigida para longe foi de 0,10 logMAR, com todos os olhos atingindo 0,18 logMAR ou melhor. **Conclusões:** Este é o primeiro relato de ceratoplastia endotelial da membrana de Descemet após implante de lente intraocular multifocal, sugerindo que bons resultados podem ser alcançados sem a troca da lente intraocular multifocal.

Descritores: Lâmina limitante posterior; Ceratoplastia endotelial com remoção da lâmina limitante posterior; Distrofia endotelial de Fuchs; Transplante de córnea; Implante de lente intraocular

INTRODUCTION

Multifocal intraocular lenses (MIOLs) achieve a high incidence of spectacle independence by delivering satisfactory far and near uncorrected vision to well selected patients[1,2]. However, after MIOL implantation, any functional or anatomic disruptions in the optical system of the operated eye have a higher risk of producing visual impairment in patients and patient dissatisfaction with the MIOL implants than that with monofocal IOLs[3,4].

Intraocular cataract surgery may cause or accelerate endothelial decompensation due to primary disorders,

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such as Fuchs endothelial corneal dystrophy (FECD), or secondary complications, such as pseudophakic bullous keratopathy (PBK) or severe cases of toxic anterior segment syndrome (TASS), which may lead to permanent endothelial damage[5]. Endothelial keratoplasty has become the primary surgical option to treat patients who develop endothelial failure. Among several techniques available, Descemet membrane endothelial keratoplasty (DMEK) has shown better visual results and a faster recovery[6,7]. The present report presents the clinical outcomes of 9 patients with previously implanted MIOLs who had endothelial decompensation managed by DMEK without MIOL exchange.

METHODS

We retrospectively analyzed the data of 9 patients (9 eyes) with previous MIOL implantation who underwent DMEK performed by 4 different surgeons. Eight eyes had AcrySof® ReSTOR® +3.0 D IOLs (Alcon Laboratories, Fort Worth, TX, USA), and 1 eye (patient 1) had an AcrySof® ReSTOR® +3.0 D Toric T5 IOL (Alcon Laboratories, Fort Worth, TX, USA) previously implanted by other surgeons. When evaluated, they all presented corneal decompensation with corneal edema. All the patients were submitted for a complete preoperative ophthalmologic examination with uncorrected and best-corrected visual acuity (although refraction was not possible in all the patients due to corneal edema and consequent low visual acuity), biomicroscopic examination, intraocular pressure measurement, indirect ophthalmoscopy, and ocular ultrasound (only in those in whom dilated fundus examination was not reliable due to corneal opacification). The follow-up period ranged from 6 to 8 months, following which the patients were lost to us because they were referred from other centers. All the patients provided written informed consent, and the Sorocaba Ophthalmology Hospital Research Ethics Committee approved the study (approval number 16523813.9.0000.0088).

RESULTS

Nine patients [9 eyes; 8 females and 1 male; age range, 58-83 years with a mean age of 69.9 years (SD=9.3)] with a previous MIOL implantation underwent DMEKs performed by 4 different surgeons in the different patients (Table 1). The indications for DMEK included PBK [in 3 eyes (33%); one with a fixated MIOL due to a traumatic surgery with posterior capsule rupture and vitreous loss], FECD [in 3 eyes (33%); 2 eyes (22%) developed endothelial failure after Descemet's membrane detachment during cataract surgery], and TASS [in one eye (11%)] (Table 1). One patient had a previous history of mild amblyopia and presented with an implanted MIOL and corneal edema with a history of Descemet's membrane detachment. All DMEK surgeries were performed between May 2013 and October 2014. The "No Touch" technique with minor modifications was performed in all patients[8]. The first modification was that the graft was prepared by the surgeon immediately prior to the operation, whereas in the "No Touch" technique, the graft is pre-dissected at an eye bank. The second modification was that graft insertion was made with a modified plastic IOL inserter instead of a glass injector. The third modification was that the primary technique to unfold the graft inside the anterior chamber was tapping onto the corneal surface instead of using an air bubble over the graft. The fourth and last modification was an inferior iridectomy to avoid pupillary block, allowing a complete air fill at the end of the procedure instead of leaving the anterior chamber with a 30%-50% air fill after a complete air fill for 45-60 minutes.

One month after treatment, all the patients had a clear cornea. After 6 months, excluding 1 eye with amblyopia, all eyes achieved best corrected distance visual acuity (BCDVA) of 0.18 logarithm of the minimal angle of resolution (logMAR) [Snellen equivalent (SE), 20/30] or better and J2 or better for near vision. At the last follow-up (ranging from 6 to 8 months after DMEK), excluding the eye with amblyopia, 62.5% of the eyes achieved BCDVA of 0.10 logMAR (SE, 20/25) or better and 25% achieved BCDVA of 0.00 logMAR (SE, 20/20) or better. In addition, at the last follow-up, also excluding the eye with amblyopia, 87.5% of the eyes achieved uncorrected visual acuity (UCVA) of 0.30 logMAR (SE, 20/40) and J2 or better, and 37.5% achieved UCVA of 0.10 logMAR (SE, 20/25) and J1 or better.

The median preoperative BCDVA was 1.30 (range, 0.54-2.00, with a 95% confidence interval between 0.72 and 1.60), and it improved significantly 6 months after the surgery, when the median reached 0.10 (range, 0.00-0.40, with a 95% confidence interval between 0.05 and 0.25), using a Wilcoxon test (p=0.000). Preoperative refraction was possible in 4 eyes; one eye maintained the same spherical equivalent after DMEK (patient 2), 2 eyes had a hyperopic shift of +0.625 diopters (D) (patients 4 and 6), and 1 eye had a myopic shift of -0.25D (patient 9).

Table 1. Patients' demographics, surgical indications, visual acuity, postoperative complications, and remarks

Patient	Gender	Age	Indications for DMEK	BCDVA (logMAR) and refraction		Complications and remarks	UCVA last follow-up	Surgeon
				Preoperative	Last follow-up			
1	F	79	DD	2.00	0.10	LASIK +0.75-2.75	0.10/j1	**NCP**
				NP	+0.25-0.50 × 60	× 70 YAG		
2	F	62	PBK	0.54	0.00	LASIK +0.50-1.50	0.00/j1	**RCG**
				+0.25-1.00 × 35	Plano	× 50		
3	F	66	TASS	1.60	0.10	RB	0.18/j2	**NCP**
				NP	+0.75			
4	F	70	FECD	0.54	0.18	CME TTM	0.18/j2	**NCP**
				0.00-1.25 × 165	+0.50-1.00 × 120			
5	M	58	PBK with FMIOL	1.60	0.00	RB	0.18/j2	**TMP**
				NP	0.00-1.00 × 90			
6	F	72	FECD	0.90	0.18	-	0.30/j2	**NCP**
				0.00-1.50 × 30	+0.50-1.25 × 45			
7	F	80	PBK	1.60	0.10	YAG	0.10/j1	**NCP**
				NP	0.00-0.50 × 60			
8	F	59	DD	1.30	0.40	Amblyopia	0.70	**WN**
				NP	0.00-1.25 × 130			
9	F	83	FECD	0.90	0.18	CME TTM + late-onset glaucoma	0.70	**NCP**
				+1.00-1.50 × 115	+1.00-2.00 × 110			

BCDVA= best-corrected distance visual acuity; CME= cystoid macular edema; DMEK= Descemet membrane endothelial keratoplasty; DD= Descemet detachment; FECD= Fuchs endothelial corneal dystrophy; Gender= female and male; LASIK= laser in situ keratomileusis; FMIOL= scleral fixated multifocal intraocular lens; PBK= pseudophakic bullous keratopathy; TASS= toxic anterior segment syndrome; NP= not possible; TTM= treated with topic medication; YAG= yttrium-aluminum-garnet laser capsulotomy; RB= re-bubble; NCP= Nicolas Cesário Pereira; RCG= Ramon Coral Ghanem; TMP= Tatiana Moura Prazeres; WN= Walton Nosé.

There were no intraoperative complications during the DMEK surgeries. Four patients presented postoperative complications. Two had partial graft detachment after DMEK and required rebubbling. The other 2 patients presented with cystoid macular edema (CME) within 1 month after DMEK but achieved BCVA of at least 0.18 logMAR for far vision and J2 for near vision after clinical treatment. One of the patients with CME developed late-onset glaucoma with elevated intraocular pressure 5 months after DMEK, which was well controlled after the regular use of hypotensive eye drops (no surgical treatment was necessary).

Two patients underwent YAG laser capsulotomy for posterior capsule opacification, which provided BCDVA of at least 0.10 logMAR and J1 for near vision. Two patients underwent excimer laser ablation for residual refractive errors (3 and 7 months after DMEK), achieving UCVA of 0.00 logMAR (SE, 20/20) and 0.10 logMAR (SE, 20/25) and J1 for near vision 1 month after laser surgery. At the last follow-up, all the patients were satisfied with their vision and no patient needed to have the MIOL exchanged.

DISCUSSION

To the best of our knowledge, this is the first report of DMEK in patients with MIOLs. In the present study, we retrospectively reviewed the outcomes of 9 patients (9 eyes) with endothelial decompensation and previously implanted MIOLs that were managed with DMEK without IOL exchange. MIOLs are known to demand a nearly perfect optical system to provide an adequate quality of vision and patient satisfaction[3,4]. The surgeons in the present study chose DMEK to manage the patients' eyes because a nearly perfect anatomical restoration of the cornea with a higher level of visual rehabilitation was needed to provide adequate vision without exchanging the MIOLs.

One patient had a previous history of mild amblyopia and presented with an implanted MIOL. This patient achieved BCDVA of 0.40 logMAR (SE 20/50) after DMEK, but despite the low acuity, he was satisfied because he had not expected better vision in this eye. This patient had excellent binocular vision with the implanted binocular MIOLs. It was decided that the MIOL should be maintained because patients with amblyopia

may benefit from the bilateral implantation of MIOLs, with better reading speeds than those of patients with unilateral nonambliopic eyes[9,10]. At the last follow-up, excluding the eye with amblyopia, all the eyes achieved BCDVA of 0.18 logMAR (SE, 20/30) or better, 62.5% of the eyes achieved BCDVA of 0.10 logMAR (SE, 20/25) or better, and 25% achieved BCDVA of 0.00 logMAR (SE, 20/20) or better. These BCDVA outcomes are similar to those in previous studies on DMEK, for example, a multicenter study from Monnereau et al. that reported 78.9% of patients with ≥20/40, 42.5% with ≥20/25, and 22.2% with ≥20/20. Another study from Droutsas et al. found 83% of patients with ≥20/40, 48% with ≥20/28, and 30% with ≥20/20[11,12].

Of our 9 patients, 2 decided to undergo YAG laser capsulotomy for posterior capsule opacification to provide a satisfactory BCDVA (0.10 logMAR and J1 for near acuity). The literature shows that YAG laser capsulotomy is often needed after MIOL[13,14]. In addition, 2 other patients underwent excimer laser ablation for residual refractive errors, achieving UCVA of 0.00 logMAR and 0.10 logMAR and J1 for near vision 1 month after laser surgery. Moreover, 6 other patients with residual refractive errors would have benefited from refractive surgery for better spectacle independence. Most of these patients had an astigmatism ≥1.00 D, not related to the DMEK surgery that had been performed through a clear corneal incision of between 2.2 and 2.75 mm.

Refraction was possible in only 4 patients before DMEK; we were not able to analyze the refractive shift in all the patients due to low visual acuity, but we found 1 eye that maintained the same spherical equivalent after DMEK, 2 eyes with a hyperopic shift of +0.625, and 1 eye with a myopic shift of -0.25. Most studies show that both hyperopic and myopic shifts are possible after DMEK, with a study by van Dijk et al. showing a mean change in the spherical equivalent of +0.33D with an average stabilization at 3 months[15]. This change in spherical equivalent can prevent spectacle independence in some patients with MIOLs after DMEK, but the main reason for residual ametropia in our series was residual astigmatism that was corrected with LASIK in 2 patients and glasses in the remaining patients.

The eyes of 2 of our patients (22.2%) required rebubbling for partial graft detachment after DMEK, which evolved well after the corrective procedure. Different rebubbling rates are found in the literature, but a multicenter study by 18 surgeons found a rate of 23.7%, very similar to that found in our series[11,16,17]. The eyes of 2 other patients (22.2%) presented with CME within 1 month after DMEK but achieved BCVA of at least 0.18 logMAR for far vision and J2 for near vision after medical treatment. The literature shows that CME is a frequent complication following DMEK, with rates as high as 12.5%, and CME has an excellent prognosis with medical treatment[18].

Our study shows that DMEK can be an effective surgical procedure to treat endothelial decompensation after MIOL implantation without the need to remove the IOL. Postoperative complications can occur as in any DMEK, but they could be managed with good outcomes in our series. Excimer laser refractive surgery and YAG laser capsulotomy may be needed to obtain better spectacle independence and better visual results. Although we got positive results with all the patients satisfied with their vision and no patient requiring the MIOL to be exchanged, a larger series with different MIOL models and a longer follow-up may be needed to better evaluate the outcomes of DMEK in patients with previously implanted MIOLs.

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