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Non-Descemet Stripping Automated Endothelial Keratoplasty for Bullous Keratopathy in Buphthalmic Eye

Koji Hirano^{a, b} Shu Kachi^b Masako Matsuura^b Kazuhide Kawase^{b, c}

^aDepartment of Ophthalmology, Ban Buntane Hotokukai Hospital, School of Medicine, Fujita Health University, Nagoya, Japan; ^bMatsuura Eye Clinic, Ichinomiya, Japan;

^cDepartment of Ophthalmology, Gifu University School of Medicine, Gifu, Japan

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Keywords

Buphthalmos · Bullous keratopathy · Non-Descemet stripping endothelial keratoplasty · Haab striae

Abstract

Purpose: To report the 2-year follow-up findings in a patient with buphthalmic bullous keratopathy (BK) who was successfully treated with non-Descemet stripping automated endothelial keratoplasty (nDSAEK). **Methods:** A 39-year-old man had an endothelial graft of 8.0 mm diameter placed uneventfully using the nDSAEK method for phakic BK with buphthalmos of the left eye. He had had a penetrating keratoplasty in the right eye due to aphakic BK 5 years earlier, which, however, resulted in the invasion of blood vessels and graft failure. Since the left eye was phakic, Descemetorhexis was not performed because the instruments might touch the crystalline lens. The best-corrected visual acuity (BCVA), intraocular pressure (IOP), and endothelial cell density (ECD) were determined at 2 weeks, and at 1, 3, 6, 12, 18 and 24 months after nDSAEK. **Results:** Twenty-four months after nDSAEK, his left cornea and lens remained clear, and the decimal BCVA was 0.8. However, the ECD of the graft had decreased from 2,274 cells/mm² before nDSAEK to 539 cells/mm² 24 months after the surgery, and the rate of decrease appeared to be slightly faster than that of former reports. An IOP of >30 mm Hg was recorded at around 2 months after the surgery, but was well controlled by tapering the topical steroids and the addition of topical brinzolamide and latanoprost. **Conclusion:** Our findings show that nDSAEK can be successfully used to treat buphthalmic BK. We

recommend that nDSAEK be considered especially in phakic eyes with a smooth posterior surface around the pupillary area.

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Introduction

The size of the eye and the cornea of patients with congenital glaucoma can be increased by elevated intraocular pressure (IOP) resulting in buphthalmos. The rapid stretching of the cornea by elevated IOP causes stresses on the corneal endothelium and the tears in Descemet's membrane called Haab striae [1]. Although corneal endothelial decompensation is a relatively common complication in buphthalmic eyes, clinicians generally hesitate to perform penetrating keratoplasty (PKP) on these eyes because of the high incidence of graft failure for nonimmunological reasons [2].

Recently, Unterlauf et al. [3] and Beltz et al. [4] reported the successful postoperative course of buphthalmic bullous keratopathy (BK) patients treated by Descemet stripping automated endothelial keratoplasty (DSAEK) using endothelial grafts of 9.5–10.5 mm diameter, which are larger than the conventional ones usually used (8.0 mm). More recently, Quiendrino et al. [5] reported successful outcomes of Descemet membrane endothelial keratoplasty for buphthalmic BK by using a graft with a larger diameter. Because of the enlarged area of endothelial decompensation, large-size endothelial grafts are recommended to supply a sufficient number of endothelial cells. However, for the DSAEK, donor punches of these larger sizes are generally not available in most general hospitals.

We report our 2-year follow-up findings in a case of BK in a buphthalmic eye that was successfully treated with non-Descemet stripping automated endothelial keratoplasty (nDSAEK) [6] with an 8.0-mm-diameter endothelial graft.

Patient and Methods

A 39-year-old man underwent nDSAEK on his left eye for phakic BK with buphthalmos. He had been diagnosed with bilateral congenital glaucoma in his childhood and had undergone bilateral glaucoma surgery at the age of 5 years. A PKP was performed on the right eye 5 years before, at the age of 34 years, to reduce ocular pain due to bulla. After the PKP, the stromal edema persisted, and the epithelial defect on the graft led to an invasion of blood vessels and graft failure at 9 months (fig. 1a).

Because the right eye was amblyopic, the patient chose not to undergo a repeat PKP; however, the decompensation of the left corneal endothelium gradually progressed, and he complained of blurred vision due to the corneal edema (fig. 1b). The decimal visual acuity of the left eye had decreased to a noncorrectable 0.15, and we decided to perform an endothelial keratoplasty on his left eye. Because the eye was phakic with accommodation and the Haab striae had not crossed over the pupillary area, we decided to perform a nDSAEK to minimize the risk of touching the crystalline lens with the surgical instruments. Informed consent was obtained from the patient for the surgery and for the use of the findings during the clinical course for future research.

nDSAEK on the left eye was performed under peribulbar anesthesia at the Matsuura Eye Clinic by one of the authors (K.H.). The endothelial cell density (ECD) of the graft before surgery was 2,274 cells/mm². The donor corneoscleral button was dissected to a depth of 300 μm, and the endothelial graft was cut with an 8.0-mm-diameter donor punch from the endo-

thelial side. The endothelial graft was inserted into the patient's anterior chamber through a 5-mm temporal corneal tunnel by Kobayashi's double glide technique [6]. After the corneal tunnel was sutured by 10-0 nylon, the graft was unfolded and centered by gently stroking the patient's epithelial surface with a strabismus hook. Then, the anterior chamber was filled with air to tamponade the graft against the cornea. Because of the large discrepancy between the diameter of the patient's cornea and the graft, it took a longer time to adjust the graft to sit over the intended area. The interface fluid was drained from the four full-thickness venting incisions of the patient's corneal stroma, and the patient remained supine for 3 h.

Postoperatively, the patient was given topical 0.1% betamethasone 4 times/day for 2 months, which was tapered to 2 times/day for 4 months. The decimal best-corrected visual acuity (BCVA), the IOP measured by applanation tonometry, and the ECD at the central cornea were determined at 2 weeks, and at 1, 3, 6, 12, 18 and 24 months after the surgery.

Results

Twenty-four months after the nDSAEK, his left cornea was clear (fig. 2a), and the BCVA was 0.8. There was no progression of lens opacity during the 2-year postoperative period (fig. 2b), and he was satisfied with the vision in his left eye. However, the ECD at the central cornea was 539 cells/mm² at this time.

The course of the ECD, BCVA and IOP before and after the surgery is shown in table 1. The changes in the ECD indicated a progressive reduction, especially in the first 12 months, but the rate of cell loss was slower in the next 12 months. Because the IOP was >30 mm Hg at around 2 months after the surgery, the topical 0.1% betamethasone of 4 times/day was tapered to 2 times/day and 1% brinzolamide and 0.005% latanoprost eye drops were added. The IOP was well controlled in the high teens to mid-twenties 5 months postoperatively. Perimetry with the Humphrey 30-2 program at 6 months after the surgery did not show any abnormalities of the static visual field, which was confirmed 24 months after the surgery.

Discussion

The endothelial keratoplasty performed on this patient differed from the endothelial keratoplasties performed for BK in eyes with buphthalmos [3–5]. First, we did not perform Descemetorhexis, and second, we used a smaller corneal graft of 8.0 mm diameter. In conventional DSAEK, the Descemet membrane is stripped to remove the opaque posterior tissue as well as to remove the irregular posterior surface for the easy attachment of the endothelial graft to the host cornea. In 2008, Kobayashi et al. [6] reported good outcome after nDSAEK for patients with non-Fuchs-type BK. This procedure could be applied for the BK patients with a smooth posterior corneal surface and without an opaque Descemet membrane or posterior collagenous layer. We chose nDSAEK for the endothelial transplantation in this patient for three reasons. First, we had to reduce the risk of touching the crystalline lens by the surgical instruments and thus induce cataracts. Second, because of the experience of successful nDSAEK in graft failure patients after PKP, we assumed that if the irregularity of the posterior cornea was not severe, it should not prevent the attachment of the endothelial graft. And third, the Haab striae did not cross over the pupillary area, and did not need to be removed to improve vision.

Considering the centrifugal migration of the endothelial cells from the graft to the host cornea, it would have been better to transplant a larger graft. However, to minimize the area of the graft which crossed over the Haab striae, we used an 8.00-mm-diameter donor punch to cut the endothelial corneal graft. Despite the difficulty in aligning the endothelial graft, the surgery was performed uneventfully.

The ECD decreased from 2,274 cells/mm² before nDSAEK to 539 cells/mm² 24 months after surgery. The rate of cell loss progressed rapidly during the first 12 months and then slowed down thereafter. An endothelial cell loss of 76.3% in 2 years is higher than that in former reports [3–5], and the smaller endothelial graft might be the possible cause of the rapid decrease in the ECD. However, the clarity of the cornea remained, and the BCVA was 0.8 at 24 months. When a repeat DSAEK is needed by graft failure, larger endothelial grafts of >9.0 mm diameter would be needed. At that time, we will have to strip the host's Descemet membrane during the removal of the failed endothelial graft.

We cannot simply compare the results of PKP on the right eye and nDSAEK on the left eye in this patient, because the right eye was aphakic and had undergone vitrectomy and was amblyopic. However, endothelial keratoplasty has been reported to be safer than PKP for the treatment of BK in eyes with buphthalmos [3–5, 7], and if a smooth posterior surface is present around the pupillary area, we recommend that nDSAEK be considered in buphthalmic eyes.

Acknowledgement

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Statement of Ethics

This study was approved by the Research Ethics Committee of Fujita Health University and complied with the Declaration of Helsinki guidelines. Written informed consent was obtained from the patient.

Disclosure Statement

The authors report no conflicts of interest in this work.

References

- 1 Coran JB, Smith EM Jr, Arentzen JJ: Congenital corneal opacities. Diagnosis and management; in Krachmer JH, Mannis MJ, Holland EJ (eds): *Cornea. Fundamentals of Cornea and External Disease*. St Louis, Mosby, 1997, vol 1, pp 368–369.
- 2 Toker E, Seitz B, Langenbucher A, Dietrich T, et al: Penetrating keratoplasty for endothelial decompensation in eyes with buphthalmos. *Cornea* 2003;22:198–204.
- 3 Unterlauff JD, Weller K, Geerling G: A 10.0-mm posterior lamellar graft for bullous keratopathy in a buphthalmic eye. *Cornea* 2010;29:1195–1198.
- 4 Beltz J, Madi S, Santrum P, et al: Descemet stripping automated endothelial keratoplasty for endothelial decompensation in buphthalmos. *Am J Ophthalmol* 2013;156:608–615.
- 5 Quilendrin R, Yeh R-Y, Dapena I, et al: Large diameter Descemet membrane endothelial keratoplasty in buphthalmic eyes. *Cornea* 2013;32:e74–e78.

- 6 Kobayashi A, Yokogawa H, Sugiyama K: Non-Descemet stripping automated keratoplasty for endothelial dysfunction secondary to argon laser iridotomy. *Am J Ophthalmol* 2008;146:543–546.
- 7 Nahum Y, Mimouni M, Busin M: Risk factors predicting the need for graft exchange after Descemet stripping automated endothelial keratoplasty. *Cornea* 2015;34:876–879.

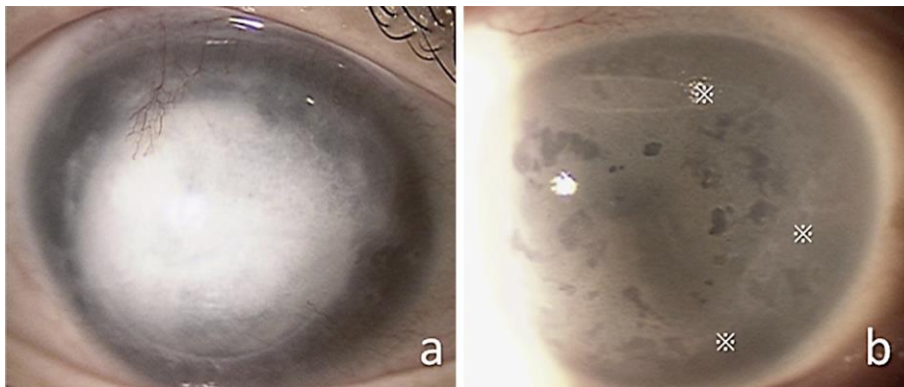


Fig. 1. Slit-lamp photographs of the anterior segment of both eyes of a patient with buphthalmic BK before the surgery of the left eye. **a** Corneal appearance of the right eye under diffuse illumination 5 years after PKP due to BK. Hazy graft with an invasion of vessels can be seen. **b** Left cornea observed by sclerotic scattered light. Diffuse corneal epithelial edema with bulla can be seen as black specks. * = Haab striae.

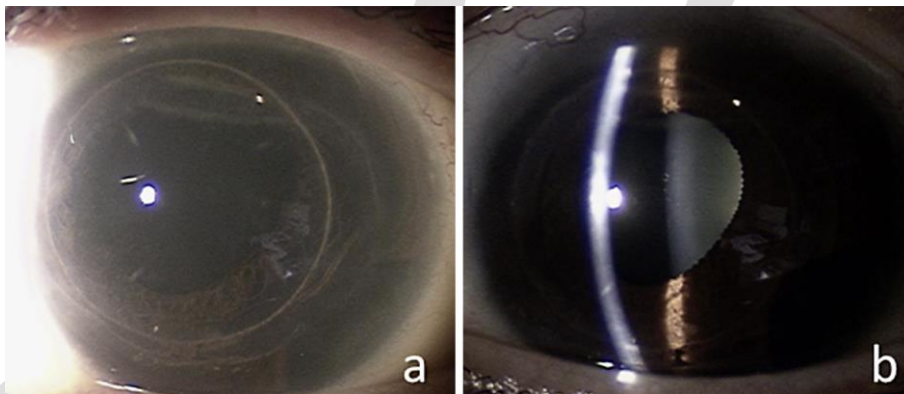


Fig. 2. Slit-lamp photographs of the left cornea 24 months after nDSEK. **a** The cornea remains clear without stromal or epithelial edema. The endothelial graft is present over the pupillary area. Haab striae can be seen at the edge of the endothelial graft. (observed under sclerotic scattered light). **b** The lens does not show any obvious opacity.

Table 1. ECD, BCVA, IOP before and after nDSEK of 24 months' follow-up

	ECD, cells/mm ²	BCVA, Snellen score	IOP, mm Hg
Before surgery	2,274	0.15	14
0.5 mo	1,494	not measured	11
1 mo	1,536	0.7	19
2 mo	1,795	0.4	30
6 mo	1,228	0.5	16
12 mo	765	0.6	20
18 mo	547	0.8	16
24 mo	539	0.8	25

mo = Months.