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CASE REPORT

Descemet Stripping PocketMaker Endothelial Keratoplasty

Guzel Bikbova, Mukharram Bikbov, Albert Daxer

ABSTRACT

Purpose: To develop a method of producing the transplant for Descemet stripping endothelial keratoplasty using the PocketMaker device (Dioptex, Austria).

Materials and methods: A new application of the PocketMaker microkeratome (Dioptex) is described for preparing thin grafts for endothelial keratoplasty. We report a case of Descemet's membrane detachment treated with a PocketMaker-prepared graft 110 mK thick.

Results: Visual acuity increased from 0.05 to 0.6. The 106 µm thick (in the center) graft remained attached and clear after Descemet stripping PocketMaker endothelial keratoplasty (DSPEK).

Conclusion: DSPEK is another use for the PocketMaker device, which can create thin endothelial grafts about 100 µm thick.

Keywords: DSAEK, Bullous keratopathy, Keratoplasty, PocketMaker, Microkeratome.

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INTRODUCTION

Traditionally, disorders of the endothelium have been treated by penetrating keratoplasty (PKP). In the United States Fuchs dystrophy and pseudophakic bullous keratopathy (PBK) are the most frequent indications for corneal transplantation.[1] With new technologies the procedure can be performed by replacing only the innermost layers of the cornea, rather than the whole cornea. Although it has been used successfully for over a century, PKP may result in inadequate wound healing or astigmatic error changes.[2] The presence of an avascular graft-to-wound interface lowers globe stability and maintains the risk of dehiscence years after surgery.[3]

In endothelial keratoplasty (EK), only a part of the recipient's posterior cornea is removed. Because the graft is thinner, less foreign antigen is present. Sutureless techniques induce minimal astigmatism. The absence of a large full-thickness penetrating wound also lowers the risk of dehiscence. New techniques in EK make possible the surgical treatment of corneal endothelial disease with a lower risk of rejection, improved globe stability and faster visual recovery than traditional full-thickness corneal transplantation.[4]

In 1954, Charles Tillett performed the first posterior lamellar keratoplasty, in a 68-year-old man with bilateral endothelial decompensation after cataract extraction.[5] In 1998, GR Melles suggested a new technique, which he named posterior lamellar keratoplasty (PLK), involving dissection of a posterior recipient lamella and transplantation of an unsutured posterior lamellar donor disk consisting of posterior stroma, Descemet's membrane and endothelium through a scleral incision.[6] Later, MA Terry suggested deep lamellar endothelial keratoplasty (DLEK).[7] In 2004, GR Melles suggested performing descemetorhexis from the anterior chamber. The transplant consisted of the posterior stroma, Descemet's membrane and endothelium (DSEK).[8] In 2006, Gorovoy reported the use of a microkeratome instead of manual dissection of the donor graft, calling the procedure Descemet stripping automated endothelial keratoplasty (DSAEK).[9,10] According to a recent publication, the thinner the graft the better the postoperative best corrected visual acuity (BCVA).[11] Femtosecond lasers have been proposed for this use. Unfortunately, femtosecond laser technology cannot provide consistently high quality, thin graft tissue. The cuts are not as smooth as with a microkeratome, perhaps due to some compression or irregularity of the posterior stroma. A double-pass ultra-thin DSAEK technique that can be performed with Moria's new microkeratome system has been introduced by Professor Busin of Italy and is demonstrating good early results.[12] In any case, the high-cost of microkeratomes and femtosecond lasers prevents the widespread use of DSAEK in clinical practice.

In 2007, Daxer developed the PocketMaker microkeratome, which was used to create a closed intracorneal pocket 300 µm deep under the surface of the cornea. Then the continuous ring-shaped inlay was implanted into the pocket to treat high myopia and keratoconus.[13,14]

In this article, we report a new combination of surgical techniques that employs the PocketMaker microkeratome for endothelial keratoplasty.

MATERIALS AND METHODS

Case Report

The patient was a 65-year-old female with Descemet's membrane detachment and bullous keratopathy developed 3 weeks after phacoemulsification with intraocular lens (IOL)

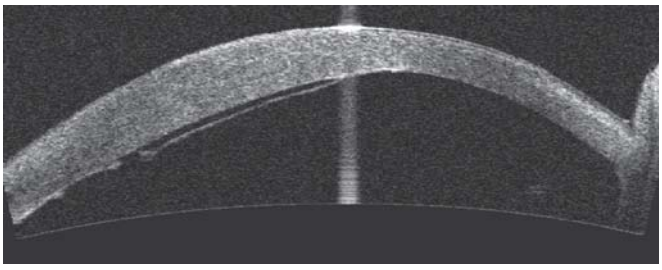

Fig. 1: OCT image of Descemet's membrane detachment

(Acrysof Natural, Alcon) implantation. BCVA was 0.05 and optical coherence tomography (OCT) (Visante OCT, Carl Zeiss Meditec, USA) images showed Descemet's membrane detachment of the inferior part of the cornea (Fig.1). The patient provided informed written consent.

Surgical Technique

The PocketMaker microkeratome was used for the first step of graft preparation—lamellar dissection. The advantage of using the PocketMaker is that the graft can be made from the corneoscleral button using the specially designed artificial anterior chamber, or from the whole eyeball (Fig. 2) using standard equipment for corneal intrastromal implantation surgery. The microkeratome consists of a suction ring, an applicator with a guiding platform for the handpiece, a handpiece containing a motor-driven blade that vibrates in the cutting plane, a control unit and a disposable transparent applanator that defines the depth of the pocket from the anterior surface of the cornea. Applanators ranging from 200 to 500 µm can be used to prepare as thin a graft as possible.

The depth of the cut was determined according to the pachymetry of the residual stroma (pachymetry should be performed before and after the first debulking step to determine the tissue thickness and choose the appropriate applanator). Then an anterior lamellar cap was removed from the posterior portion. The second cut was made depending on the tissue thickness, with the goal of ultimately creating a graft that is approximately 130 microns or less.

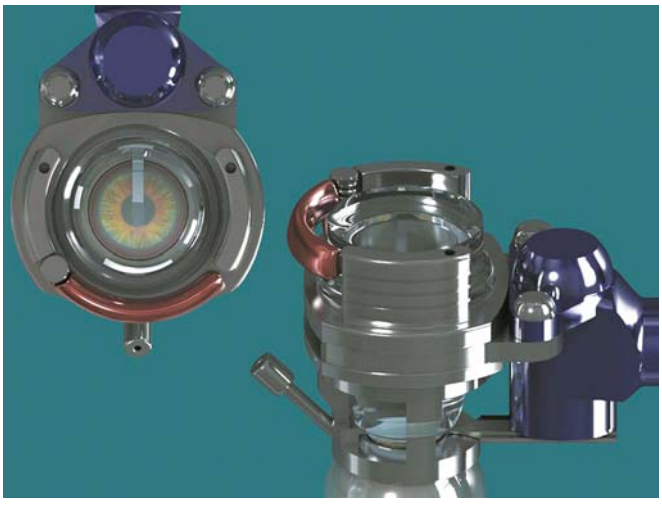

Fig. 2: Preparing corneal pocket on the eyeball

In the described case the graft thickness was 106 µm in the center and 180 µm in the periphery. Each microkeratome pass should be made very slowly and steadily. The second lamellar cap should not be removed. All residual posterior portion of the donor cornea should then be transferred endothelial side up and punched for the needed diameter. As the PocketMaker microkeratome is able to perform the pocket for 9 mm diameter, the graft diameter might be gained 8.75 mm or less.

We performed Descemet stripping endothelial keratoplasty by the following technique. In the recipient cornea, four venting incisions were made in the midperipheral cornea before donor insertion. Then, a 4.5 mm temporal incision for scleral tunnel forming was made. The inferior peripheral iridotomy was then performed. The corneal surface was lightly marked with an 8 to 8.5 mm marker to outline where to strip the recipient Descemet's membrane and to highlight the fixation area of the graft. The air bubble was introduced to the anterior chamber. Descemet's membrane was stripped in a circular pattern (descemetorhexis) under the area of the epithelial reference mark with an anteriorly bent needle or custom-made instrument (modified Price–Sinskey hook). Descemet's membrane and endothelium were completely stripped from the marked area and removed from the anterior chamber with a spatula or Descemet's stripping instrument. The trephined donor corneal lenticule (containing posterior stroma, Descemet's membrane and endothelium) was brought into the operative field, a small amount of viscoelastic was placed on the endothelial surface and the graft was provided into anterior chamber using the Endoglide injector (Coronet, UK). Using long DSAEK forceps, the donor disk was gently grasped and inserted into the eye. The incision was closed with 10-0 nylon sutures, and the anterior chamber was maintained by an inflow of air.

RESULTS

The operation resulted in restoration of corneal integrity and transparency. Best corrected visual acuity increased from 0.05 to 0.1 in the first week, then to 0.63, months after the operation. The graft remained attached and clear after DSPEK (Fig. 3).

DISCUSSION

Historically, patients with endothelial decompensation were treated by PKP only, requiring a long follow-up period and

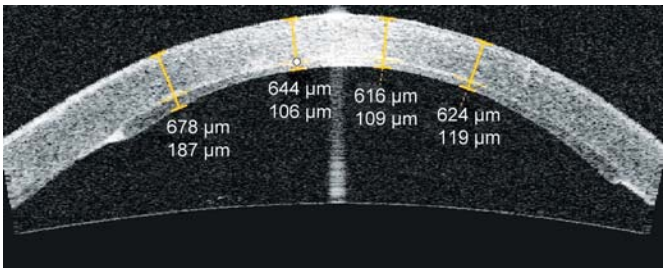

Fig. 3: OCT image 3 months after DSPEK. The graft is attached

resulting in multiple changes in refractive error. The past decade has seen a revolution in the surgical treatment of bullous keratopathy. DSAEK has provided patients with a minimally invasive surgical treatment that significantly improves uncorrected vision and does not change globe stability. The PocketMaker microkeratome creates the stromal pocket parallel to the corneal collagen fibrils and provides surgeons with an ultrathin high-quality graft from as preserved cornea and from the whole eyeball. This feature will help spread DSAEK technology for the treatment of endothelial decompensation worldwide.

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