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## Original article

# Visual acuity and endothelial cell density following Descemet membrane endothelial keratoplasty (DMEK)<sup>☆</sup>

I. Dapena<sup>a,f,g,h,\*</sup>, L. Dapena<sup>b,c</sup>, M. Dirisamer<sup>a,f,g,h</sup>, L. Ham<sup>d,f,g,h</sup>, G.R.J. Melles<sup>a,e,f,g,h,\*</sup>

<sup>a</sup> Graduate in Medicine

<sup>b</sup> Graduate in Veterinary Sciences

<sup>c</sup> Ph.D. University of León

<sup>d</sup> Graduate in Health Sciences

<sup>e</sup> Ph.D. in Medicine

<sup>f</sup> Netherlands Institute for Innovative Ocular Surgery, Rotterdam, Netherlands

<sup>g</sup> Melles Cornea Clinic Rotterdam, Rotterdam, Netherlands

<sup>h</sup> Amnitrans EyeBank Rotterdam, Rotterdam, Netherlands

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## ABSTRACT

**Purpose:** To assess the clinical outcomes of DMEK in the first series of 120 eyes operated for the treatment of Fuchs endothelial dystrophy in terms of visual acuity and endothelial cell density.

**Methods:** The first 120 consecutive eyes that underwent DMEK (i.e. transplantation of an isolated donor Descemet membrane with its endothelium) were evaluated. In all eyes, the best corrected visual acuity (BCVA) before and at 1, 3 and 6 months after surgery, as well as the endothelial cell density (ECD) before and at 6 months were measured.

**Results:** In eyes with a functional DMEK graft and good visual potential (n = 96), the BCVA was  $\geq 20/40$  ( $\geq 0.5$ ) in 77% after 1 month, 92% after 3 months, and 95% after six months;  $\geq 20/25$  ( $\geq 0.8$ ) in 50%, 63%, and 73% of the cases, and  $\geq 20/20$  ( $\geq 1.0$ ) in 23%, 34%, and 45% of the cases at 1, 3, and 6 months, respectively. In this group, ECD averaged 2610 ( $\pm 185$ ) cells/mm<sup>2</sup> before, and 1770 ( $\pm 520$ ) cells/mm<sup>2</sup> at six months after surgery (n = 96). In 15 eyes, a secondary Descemet stripping endothelial keratoplasty (DSEK) was performed. In this group, 91% of patients reached a BCVA of  $\geq 20/40$  ( $\geq 0.5$ ) and only one patient achieved a BCVA of 0.8 at 6 months after surgery (n = 11). Furthermore, ECD averaged 2580 ( $\pm 185$ ) cells/mm<sup>2</sup> before and 1310 ( $\pm 740$ ) cells/mm<sup>2</sup> at six months (n = 13).

**Conclusion:** DMEK provides a fast and high visual rehabilitation. Endothelial cell density loss may be similar to earlier types of endothelial keratoplasty.

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\* Corresponding authors.

E-mail addresses: isadapena@gmail.com (I. Dapena), melles@niioc.nl (G.R.J. Melles).

URL: <http://www.niios.com> (G.R.J. Melles).

## Agudeza visual y densidad de células endoteliales tras queratoplastia endotelial de membrana de Descemet (DMEK)

### R E S U M E N

#### Palabras clave:

Queratoplastia endotelial de membrana de Descemet  
Queratoplastia lamelar posterior  
Trasplante corneal  
Membrana de Descemet  
Endotelio  
Agudeza visual  
Densidad celular endotelial

**Objetivo:** Evaluación de los resultados visuales y de la densidad de células endoteliales en los 120 primeros ojos sometidos a queratoplastia endotelial de membrana de Descemet (DMEK) como tratamiento para la distrofia endotelial de Fuchs.

**Material y métodos:** Se evaluaron los primeros 120 ojos sometidos a DMEK. En todos ellos se midió la agudeza visual mejor corregida (AVMC) antes y al 1, 3 y 6 meses después de la cirugía, así como la densidad celular endotelial (DCE) antes y a los 6 meses.

**Resultados:** En los ojos con trasplante exitoso y sin patologías concomitantes ( $n=96$ ), se observó una AVMC  $\geq 0,5$  en el 77% de los casos al mes de la cirugía, en el 92% a los 3 meses y en el 95% a los 6 meses. La AVMC fue  $\geq 0,8$  en el 50%, 63% y 73% de los casos y  $\geq 1,0$  en el 23%, 34% y 45% al 1, 3 y 6 meses después de la cirugía, respectivamente. La DCE preoperatoria fue 2.610 ( $\pm 185$ ) células/mm<sup>2</sup> y 1.770 ( $\pm 520$ ) células/mm<sup>2</sup> a los 6 meses postcirugía. En quince ojos se realizó una queratoplastia endotelial con pelado de la membrana de Descemet (DSEK) secundaria. En este grupo, el 91% de los pacientes alcanzó una AVMC  $\geq 0,5$ , alcanzando solo uno de ellos una AVMC de 0,8 ( $n=11$ ) a los 6 meses. Además, la DCE media fue de 2.580 ( $\pm 185$ ) células/mm<sup>2</sup> antes y de 1.310 ( $\pm 740$ ) células/mm<sup>2</sup> a los 6 meses de la operación ( $n=13$ ).

**Conclusiones:** DMEK permite una rápida y casi completa rehabilitación visual. La DCE postoperatoria observada es comparable al obtenido con técnicas precedentes de queratoplastia endotelial.

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## Introduction

In 1998, we described a first endothelial keratoplasty technique for treating corneal endothelium pathologies in which the altered layers were substituted by a posterior corneal layer (a posterior stroma layer with Descemet's membrane and endothelium). This technique is now known as *Deep lamellar endothelial keratoplasty* (DLEK).<sup>1-3</sup> A subsequent development of endothelial keratoplasty involved the introduction of "descemethorexis", in which Descemet's membrane with its endothelium was separated from the receiving cornea.<sup>4</sup> In this way, the donor layer was placed in contact with the intact receiving stroma. This technique was denominated *Descemet stripping (automated) endothelial keratoplasty* (DSEK/DSAEK).<sup>2-11</sup>

DLEK and DSEK/DSAEK were accepted widely because they reduced the typical complications of penetrating keratoplasty such as high astigmatism, suture-derived complications or incision dehiscence.<sup>2</sup> Even though the visual results of the DLEK and DSEK/DSAEK techniques were better than for penetrating keratoplasty because they achieved a visual acuity of 0.5-0.6 after about 6 months post-surgery,<sup>3,12</sup> they did not enable the maximum visual potential. The cause of this limited visual result could be because the excess stroma of the donor layer caused a distortion of the normal corneal anatomy.<sup>3</sup> Under the assumption that the recovery of the normal corneal anatomy enhanced its optical quality and therefore improved vision, we have developed a modification of endothelial keratoplasty by means of which, after "descemethorexis", only the isolated Descemet membrane with endothelium is transplanted, excluding the stroma. We have called this technique *Descemet membrane endothelial keratoplasty* (DMEK).<sup>13-15</sup>

As DMEK involves a greater surgical challenge, it should also provide better visual results for it to become a true development of the previous techniques. Accordingly, the purpose of this study is to analyze the results of the DMEK surgical technique for treating Fuchs endothelial dystrophy in terms of visual acuity and endothelial cell count.

## Subjects, material and methods

### Patients

This study comprised 120 DMEK-type operations, 105 patients, 46 males and 59 females with ages between 41 and 89 years (mean age  $67.4 \pm 12.4$  years) who suffered Fuchs endothelial dystrophy (Fig. 1). Nineteen eyes were affected and the rest pseudophakic.

All the patients signed an informed consent approved by the Institutional Review Board (IRB).

### Donor tissue

The corneas were obtained from donor ocular globes less than 36 h post-mortem. The corneal-scleral rings were removed and kept in organ culture tissue (CorneaMax, Laboratoires Eurobio, Les Ulis Cedex, France) at 31 °C.<sup>16</sup> One week later, endothelial cell count was made (at least 2300 cells/mm<sup>2</sup>) and the morphology was analyzed.

For subsequent tissue preparation, the cornea was attached to a custom-design vacuum support and Descemet's membrane (DM) was "peeled" off the posterior stroma utilizing small tweezers. Due to the elastic properties of DM, it rolled up spontaneously with the endothelium on the outer side.

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