Review of Intraoperative Methods to Enhance Visualization During Descemet Membrane Endothelial Keratoplasty (DMEK)

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Abstract

Introduction: Descemet membrane endothelial keratoplasty (DMEK) has replaced penetrating Keratoplasty (PKP) in many cases, when the pathology was found to involve only the corneal endothelium. Since it has been first described by Melles in 2006, it offered a great advance in the field of lamellar Keratoplasty. DMEK is associated with lower rate of complications particularly rejection as well as faster visual recovery and almost ideal refractive results. The surgery itself although might be considered as a simple procedure, it is associated with a learning curve and some difficulties. One of the most obvious difficulties is poor visualization during graft manipulation, which is not uncommon mainly due to corneal edema and intraoperative hyphema.

Methods: A review of the literature was done using PUBMED and Google Scholar during the period from January 2012 till January 2020.

Results: Causes of poor visualization during DMEK was mentioned as described by authors, and methods to overcome this obstacle were mentioned as well. These methods ranged from using expensive tools such as using intraoperative optical coherence tomography (iOCT) to using simpler optical hand held slit beam or even using the retroillumination of the surgical microscope to enhance red reflex. This variety of options described by senior surgeons made it easier for the younger surgeons particularly in their early cases to deal with complex cases with more confidence.

Conclusion: DMEK has been considered the gold standard for treatment of a large sector of corneal endothelial pathologies. Poor visualization during the procedure has been solved by many optical and chemical methods to get the best surgical outcomes.

Keywords: Descemet Membrane Endothelial Keratoplasty (DMEK); Intraoperative Optical Coherence Tomography (iOCT)

Introduction

Descemet Membrane Endothelial Keratoplasty (DMEK) is one of the most successfully and widely performed lamellar keratoplasty procedures. It has offered an advanced revolution in the surgical management of corneal endothelial diseases such as Fuchs endothelial dystrophy and pseudophakic bullous keratopathy. For many cases DMEK replaced the full thickness penetrating keratoplasty (PKP) by a simpler and more successful surgery with much less complications [1,2]. Moreover, it has better visual and refractive outcomes as well as much less rejection rate [3,4] which have encouraged surgeons from all over the world to learn the relatively new technique, making it the most performed type keratoplasty over the last years [5].

Dealing with the thin DMEK graft intraoperatively needs good visualization, particularly the operated corneas are more or less edematous which makes it so challenging to manipulate the graft.

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In this brief review, I’ll be mentioning the most frequently used methods by surgeons to overcome poor intraoperative visualization.

**Conditions of poor intraoperative visualization of DMEK graft**

Intraoperative visualization is usually more difficult in patients with dark colored irides in comparison with patients with light colored irides. Dense arcus senilis or corneal opacity adds to the difficulty of visualization.

The main issue is operating on edematous corneas due to the nature of the diseased cornea, as a cornea with poor endothelial function will lose the main factor for its dehydration.

Lower peripheral iridotomy (PI); is an important step in the surgery, performed by most surgeons, to prevent pupillary block by the big air bubble, left in the AC to support the graft [6,7]. PI could be associated with intraoperative hyphema that makes visualization even worse [8].

**Intraoperative methods used to enhance DMEK graft visualization**

Surgeons uses methods to enhance visualization in opaque corneas such as debridement of edematous epithelium and intraoperative use of topical glycerin as an osmotic agent, to absorb fluids from the edematous corneal stroma [9,10].

Intraoperative hyphema should be well managed by irrigation or pressurizing the anterior chamber either with balanced salt solution or viscoelastic substances [11].

Trypan blue stain should be used efficiently to stain both the donor graft and the recipient endothelial tags [12]. Using a marker e.g. S-stamp is so beneficial in determining the correct orientation of the graft [13].

Intraoperative optical coherence tomography (iOCT) offers excellent visualization in lamellar keratoplasty [14] but because of its high price, many surgeons use other economic alternatives.

Hand held slit beam was described as an efficient device to identify the correct graft orientation and prevent upside-down graft implantation which leads to primary graft failure. In case of intraoperative hyphema, the slit beam is better than iOCT which gives poor quality of images in the presence of anterior chamber blood [15].

The use of endoilluminator is another intelligent method of using the already available endoilluminator for vitreoretinal surgery in enhancing DMEK graft visualization [16].

Recently, authors described that using the coaxial light of the surgical microscope while dimming the oblique beam, as an effective method for enhancing the red reflex, which makes a good contrast to visualize the graft [17].

Other authors recently described the ghost DMEK technique as they used a simple method of staining the periphery of the graft by staining the donor punch using a gentian violet marker [18].

**Conclusion**

DMEK graft visualization could be very challenging in many complex cases. There are many methods and devices that could solve the problem allowing the surgeon to get a smooth surgery with better outcome. Availability of optical devices and training of the surgeons on different methods to enhance visualization, are important factors for the surgical success.
Bibliography


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