




# Surgical gonioscopes for tag identification and removal in DMEK surgery

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## Abstract

**Introduction:** We describe a novel technique for identifying endothelial Descemet membrane (DM) tags remaining after descemetorhexis in patients undergoing Descemet membrane endothelial keratoplasty (DMEK) surgery.

**Methods:** A surgical gonioscope is applied to the corneal surface after descemetorhexis in order to visualize the peripheral inner corneal layer at 360° and identify endothelial-DM tags.

**Results:** A detailed visualization of the peripheral inner corneal layer is possible using gonioscopes, without using any staining in the anterior chamber.

**Conclusion:** The technique may be used to screen the posterior corneal surface for any retained endothelial-DM tags. It may lower the risk of remaining tags and indirectly lower the incidence of DMEK graft detachment.

## Keywords

Cornea, DMEK, gonio lens, tags, graft detachment

## Introduction

In Descemet membrane endothelial keratoplasty (DMEK) surgery the risk of postoperative graft detachment may be high, ranging from between 2 and 63%.<sup>1-4</sup> DMEK graft detachment impacts on speed of visual recovery and may require additional manoeuvres (re-bubbling) with further endothelial cell loss.<sup>5-7</sup> An incomplete removal of the host Descemet and corneal endothelium from the landing zone of the donor graft creates tags that interfere with the attachment of the donor tissue.<sup>8</sup> Retention of Descemet membrane (DM) in the host-donor interface may cause a detachment because the tissue springs away from the recipient posterior stroma. Therefore, an accurate descemetorhexis and tag identification is essential for lowering the risk of graft detachment. Previous studies reported the use of air bubble, trypan blue or microscope-integrated intraoperative optical coherence tomography (Mi-OCT) for the visualization of DM tags on donor cornea.<sup>9-12</sup> Here we describe that the surgical gonioscope, normally used during glaucoma surgery to visualize the irido-corneal angle,<sup>13</sup>

may help to visualize and guide the removal of tags after descemetorhexis before graft insertion during DMEK surgery.

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## Methods

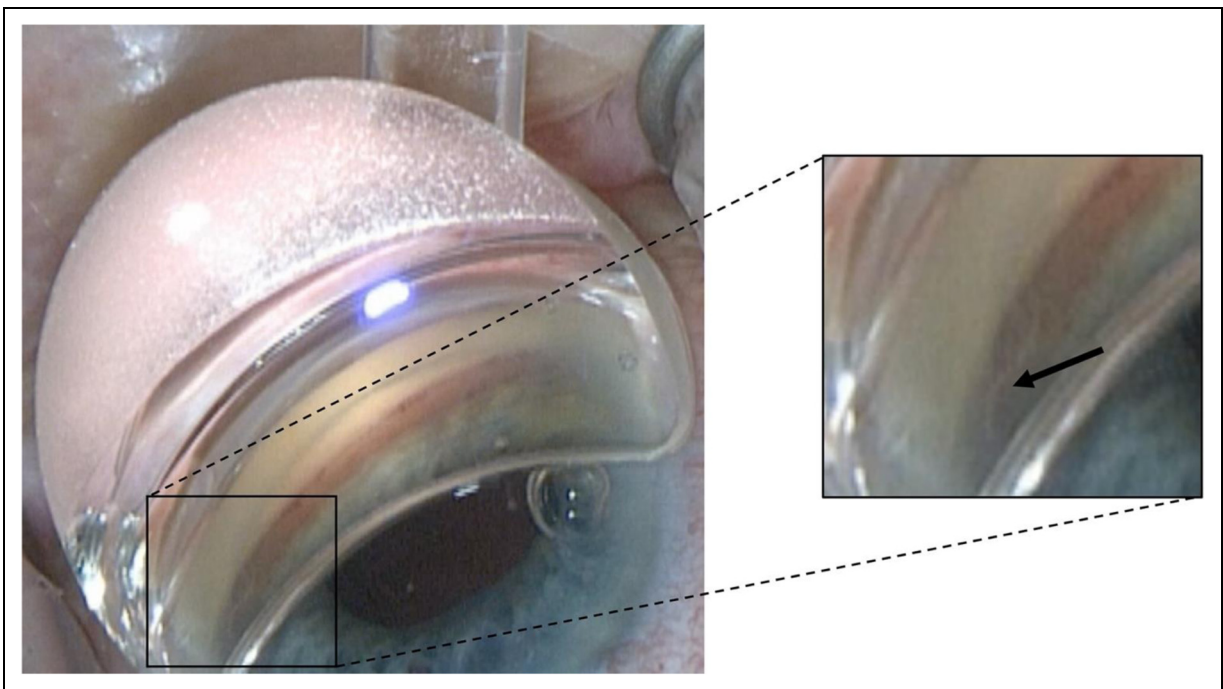
DMEK surgery was performed in a standard fashion, briefly, using a 3.2 mm keratome (Beaver Xstar; Beaver-Visitec International, Milton, UK) a temporal main wound was made, with a 20g MVR blade (MANI, Kofu, Japan) superior and inferior paracenteses were performed; using a reverse sinsky hook a 9 mm descemetorhexis under viscoelastic (ProVisc, Alcon, USA) was completed. After descemetorhexis, the microscope was adjusted with an inclination of 45 degrees, a surgical gonioscope (iprismS, GlaucoS, USA) was used to visualize the periphery of the inner corneal layer and to detect residual tags. Using micro-vitreoretinal forceps those tags were removed. The DMEK surgery was then completed in standard fashion.

## Results

The successful visualization of the DM tags remaining after descemetorhexis is shown in Figure 1. This case demonstrates that the use of a surgical gonioscope during surgery allowed the screening of the posterior corneal surface for any retained endothelial-DM tags without the need for any staining in the anterior chamber. No intra-operative complications were observed. The present technique has been routinely and successfully used by our group in DMEK surgery. The use of gonioscopes also makes it possible to remove tags using micro-vitreoretinal forceps, as demonstrated in Figure 2 (Supplementary Video 1).

## Conclusion

Graft detachment remains one of the most important complications affecting graft survival in DMEK.<sup>14</sup> The goal to managing graft detachment would be to avoid preventable causes and identify it as early as possible. Recognizing these conditions is important to avoid secondary interventions like rebubbling.<sup>15</sup> After DMEK, the mean rate of air injection is 28.8%, this value is higher compared to after Descemet stripping automated endothelial keratoplasty (DSAEK) that is equal to 14%.<sup>16</sup> The presence of areas of incomplete descemetorhexis may be one of the causes that lead to the detachment of the donor graft. However, the real rate of detachment may be higher considering that small detachments are difficult to detect as a consequence of the local edema in the same site and that in most cases they can resolve spontaneously.<sup>17</sup> Sharma *et al* highlighted how frequent the presence of residual tags are after descemetorhexis. They imaged the recipient posterior stroma using the Mi-OCT and identified retained tags in 92% of cases.<sup>11</sup> However, it is worth highlighting that it was a cohort of patients with poor visualization due to epithelial and stromal edema (corneal central thickness > 800  $\mu\text{m}$ ). At the same time, although the Mi-OCT is currently the best method to identify tags, especially in opaque corneas, the availability and the cost of this instrument could be a concern.<sup>11</sup> Most of the series published in DMEK do not present a delayed stage of corneal endothelial decompensation, the corneal clarity is relatively better, and in these conditions the use of a surgical gonioscope could be a simpler and quicker way to check the presence of tags after descemetorhexis.<sup>11</sup> Tags could be removed under



**Figure 1.** Intraoperative image showing tags with the use of a surgical gonioscope (marked with black arrow).



**Figure 2.** Intraoperative image showing removal of a retained DM tag with intravitreal forceps with the use of a surgical goniolens.

surgical goniolens visualization using micro-vitreoretinal forceps. Furthermore, a large descemetorhexis, approximately 9.0 mm, minimizes the risk of incomplete removal of the host DM. As demonstrated by Tourtas *et al*, compared with small descemetorhexis with overlapping DM, a larger removal of the host Descemet leads to a small peripheral zone of denuded stroma without increasing the occurrence of peripheral corneal edema rate.<sup>8</sup> At the same time, the use of the goniolens allows us to view the tags even at a shorter distance, 8 mm, considering that the tags themselves protrude towards the center by well over 1 mm and have been well displayed as shown in Figure 1. Another technique to detect residual tags in the recipient eye is the use of Trypan blue dye to identify the presence of tags, however, due to the high affinity of the dye to the stroma there is the risk of excessive staining of the posterior corneal surface and as a consequence, difficult visualization of the graft during unfolding. For this reason, the time to stain the DM not be too longer.<sup>18,19</sup> Instead, the use of a surgical goniolens does not require Trypan blue and areas of incomplete descemetorhexis could be picked up which were otherwise not visible. Another alternative can be the use of air/gas bubble, however the instability of the anterior chamber in the presence of air makes this technique scarcely appreciated by surgeons because of the bothersome leakage of air during the tag removal which consequently leads to loss of tag visibility. To prevent air escaping a solution would be to place a layer of viscoelastic in the anterior chamber to cover the internal opening of the paracentesis site and to cover the external opening as well.<sup>20</sup> Moreover, it is a safe technique, no damage to the angle structures or other complications were observed during the procedure. In addition, it helped to highlight tags in the extreme periphery especially in cases of peripheral corneal opacities (like arcus or scar) where direct illumination obscures the view of the tags even when using trypan blue or air. In conclusion, the technique described herein may represent a useful alternative to the Mi-OCT, if not available, to better image the residual tags without any staining minimizing the possible risk of graft detachment after DMEK.


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