DMEK Best Practices Session 2 - DMEK & Cataract

Due to the large-scale performance of cataract surgery and the increasing practice of DMEK, research into their mutual interaction is becoming increasingly relevant. At the same time, it is essential to investigate the suitability of post-phacoemulsification corneas for transplantation to increase the available tissue pool. During this session, process improvements and tips from experts were shared to make optimal use of donor tissue and provide patients with the best care.

DMEK preparation of donor corneas with post-phaco scars

Pseudophakic donors in the Netherlands

• About 30% of donor corneas in the Netherlands come from pseudophakic donors (people with an artificial lens). Previously, these corneas were largely excluded due to quality standards for PK (Penetrating Keratoplasty), which involves replacing the entire cornea.
• With DMEK, only the Descemet membrane with endothelial cells is transplanted. This means that the overall quality of the donor cornea is less decisive, as long as the endothelial cells are healthy and functional.
• This opens the opportunity to reassess the suitability of pseudophakic donors with a specific focus on endothelial quality, which could greatly expand the available donor pool.

Challenges

• Difficult preparation: peripheral corneal incisions increase the risk of membrane rupture during dissection.
• Careful and delicate handling of the tissue is required, identification of most effective dissection technique can yield improved results.
• For AER, a modified 'no touch' technique, in which the incisions are gently loosened with a hockey stick instrument, proved to be the most successful.

Practical tips for dissection technique

• Detach the membrane peripherally, as described for the 'no-touch' technique (Groeneveld-van Beek et al., Acta Opthalmol., 2013, 145-150).
• Strip the membrane from the stroma with a McPherson forceps up to the peripheral incisions.
• Gently clear the incisions with a hockey stick instrument.
• Strip the membrane completely, perpendicular to the scars to avoid tearing.
• Place the membrane flat on a contact lens and transfer to a punch block.
• Trephine within the area of the incisions so that they remain outside the final graft.

Results

By identifying the most successful dissection technique, AER achieved a success rate of DMEK preparations of 74% (previously 54%) from donor corneas with post-phaco scars.
By no longer considering bilateral phaco as a contraindication and refining the dissection technique, AER has been able to effectively utilize additional donor tissue.
This development is of great importance given the increasing demand for corneal transplants and the increasing percentage of **pseudophakic donors** in the donor pool.

Discussion

• According to the literature, transplants that meet the criteria are comparable to those from phacic donors and perform just as well as these.

The phaco-DMEK triple procedure

• Previously, a phaco was performed first, followed by a DMEK 6 weeks later.
• A combined surgery is now being carried out in the UMCG because this is logistically more efficient.
• Triple DMEK procedure: removal of a cloudy lens, positioning of artificial lens, DMEK

Advantages

• More patient-friendly: only one surgery required.
• Logistics: no separate agreements for phaco and DMEK.
• Faster surgery and fewer materials: more environmentally friendly and time-saving.
• Technically simpler: descemetorhexis under viscoelastic support is easier than under air or water.
• Faster recovery: fewer postoperative checks and medications are required.

Practical tips for combined surgery

Phaco

• Start by marking a 3mm area along the limbus of the eye. Perform the 3mm (superficial) incision on the temporal side of the eye.
• Make the capsulorhexis slightly smaller than normal (4.5 mm instead of 5 mm) to prevent lens displacement during manipulation of the DMEK roll.
• After the capsulorhexis, remove the lens and cortex and add viscoelastic material. Increase incision to 3.2 mm to allow for leakage during DMEK roll insertion (reduces intraocular pressure).
• Remove viscoelastic material thoroughly - especially under the lens - to avoid complications when inserting the DMEK roll.

DMEK

• Use the red reflex and viscoelastic material for the descemetorhexis to facilitate endothelial removal.
• Use a double scroll for more efficient unfolding and add trypan blue to make the graft clearly visible.
• Check the correct position and orientation of the DMEK graft in the injector before inserting it.
• Partially suture the incision to deepen the anterior chamber before fully unfolding the DMEK graft.
• With a vitrectomized eye: loose roll is easier; rinse BSS behind the pupil to promote vitreous formation.
• Perform the Moutsouris Sign test to determine the orientation. Make sure the graft is properly centered.
• After proper implantation, use SF6 gas (5% diluted) to fix the graft to the stroma. Allow the gas to remain in the eye for 10 minutes and then remove it until the eye chamber is 80% full.
• After the surgery, allow the patient to rest in the recovery room for two hours.

Discussion

• Against expectations, the transition to triple DMEK did not lead to an increased rebubbling rate.
• Intraoperative OCT or marking of the DMEK graft does not appear to be strictly necessary for DMEK, as the orientation of the graft can almost always be easily determined with other techniques (e.g. Moutsouris Sign).

Optimizing refractive outcomes after phaco and DMEK

• Triple DMEK is more efficient and prevents damage to the donor endothelium.
• Biometry is less reliable due to the influence of corneal swelling on the keratometry.
• In patients with Fuchs and central swelling, the corneal curvature may be initially steeper, which may lead to an unexpectedly greater hyperopic shift after DMEK.
• Better prediction of the refractive outcome can prevent hyperopic surprises.

Corneal topography and hyperopia prediction:
• Corneal asphericity coefficient (Q value): The Q-value reflects the shape of the cornea.
• Positive Q value (oblate): corneal shape as a flattened sphere, associated with hyperopia.
• Negative Q value (prolate): cornea with a more normal or steeper profile, associated with e.g. keratoconus.

Patterns of edema
• Central edema causes steeper corneal curvature in the center and may lead to hyperopia. This is important to recognize during preoperative examination.
• Recognizing a keratoconus-like island in the anterior elevation measurement is an indication of increased risk of hyperopic shifts.

Tips for predicting a hyperopic shift
• Check the corneal topography before the surgery: note the asphericity coefficient (Q value) and patterns of central swelling of the posterior cornea.
• A positive Q value (>0) increases the risk of a hyperopic shift by a factor of three.
• The average hyperopic shift after DMEK is 0.4 diopter. The recommended target refraction is between -0.75 and -1.00 D for emmetropia.
• With an increased risk, focus on a stronger myopic correction (e.g. -1.5 to -2.0 D).
• Comparison with the fellow eye: If one eye has already undergone DMEK, use the postoperative K values of that eye for the IOL calculation of the fellow eye.
• In asymmetric Fuchs, the less affected eye may provide a better indication of the expected corneal curvature.
• In sequential surgery (cataract first, then DMEK), the second eye surgery can be better predicted by using the results of the first eye.

Discussion
• Toric IOLs and DMEK: Due to unpredictable astigmatic changes after DMEK, toric IOL implantation is not recommended. Monofocal lenses with an add-on lens if necessary are a better alternative.

Overall conclusions
• By applying an effective 'no touch' DMEK dissection method, tissue from pseudophakic donors can be used more effectively, which increases the available donor pool.
• A carefully performed phaco-DMEK triple procedure offers advantages in terms of efficiency, logistics and patient friendliness.
• A phaco-DMEK combination may affect the reliability of post-operative biometry, but with a timely and accurate prediction of the refractive outcome, hyperopic surprises can be avoided.