DMEK Challenging Cases – Prof.Dr. Martin Dirisamer

1. Role of DMEK in Endothelial Keratoplasty

- DMEK is the **dominant posterior lamellar keratoplasty technique** (≈99% of cases in German Keratoplasty registry).
- It is the **primary treatment for corneal endothelial disorders**.
- Compared with penetrating keratoplasty (PKP), DMEK is:
    - Less invasive.
    - Provides faster visual recovery.
    - Has fewer complications related to open-globe surgery

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2. What Makes a DMEK Case Challenging

Anatomical factors

- Lack of a proper diaphragm (iris–lens barrier).
- Anterior chamber IOL (AC-IOL), scleral-fixated or iris-fixated IOLs.
- Aphakia.
- Deep anterior chambers.

Interference with previous ocular surgeries

- Vitrectomy (lack of vitreous counter pressure).
- Failed Penetrating keratoplasty (PKP).
- Retinal detachment surgery.
- Multiple prior intraocular procedures.
- Glaucoma tubes.

Structural abnormalities

- Anterior chamber adhesions.
- Partial aniridia.
- Large iridectomies.

Corneal conditions

- Long-standing corneal edema.
- Corneal decompensation after complicated cataract surgery.

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3. Important Surgical Principles

Create a stable diaphragm before performing DMEK

- Often requires:
    - IOL implantation.
    - Replacement of AC-IOLs.
- Aphakic eyes generally have poor outcomes.

Manage the anterior chamber space

- Release adhesions to create space for graft unfolding.
- Deep chambers make graft manipulation harder.

Graft unfolding

Techniques include:

- Air bubble-assisted unfolding.

- Old-school bubble-over technique.
- “Carpet” unrolling method.
- Occasionally gentle manipulation with micro-forceps.

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4. Donor Selection

Preferred donor characteristics
Older donors (~70+ years)
- Advantages: looser graft rolls, easier unfolding.

Young donors
Disadvantages: tight graft rolls, harder to manipulate in deep chambers.

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5. Gas vs Air

Standard cases
- Air tamponade.

Complex cases
- 20% SF6 gas preferred.
    - Longer persistence in the eye.
    - Lower rebubbling rates.
    - Reduced risk of bubble escaping posteriorly.

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6. Special Challenging Situations

Post-vitrectomy eyes
Problems:
- Lack of vitreous counter pressure.
- Graft becomes mobile and difficult to control.

Failed PKP with endothelial decompensation
Management:
- Perform Descemetorhexis of PK graft.
- Match DMEK graft size to PK graft size.
- Avoid overlap (higher detachment rate).

Challenges:
- Thinner Descemet membrane.
- Risk of opening the PK wound.

Glaucoma patients
Common issues:
- Multiple prior surgeries, adhesions, abnormal pupils, glaucoma drainage tubes.

Higher complication rates:
- Higher rebubbling rates (up to 100%).
- Shorter graft survival.
- Higher primary graft failure.

Glaucoma tubes
Management techniques:

- Shorten the tube.
- Place temporary suture to close tube.
- Prevent air/gas escape after surgery.

Possible mechanism of endothelial failure:

- Altered aqueous humor dynamics.
- Chronic subclinical inflammation.

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7. Combined Procedures

Examples include **advanced triple procedures**:

1. Remove AC-IOL.
2. Implant new IOL (iris-claw or sulcus-fixated).
3. Close wound.
4. Perform DMEK in the same surgery.

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8. Visualization and Technology

Important tools:

- Trypan blue staining.
- Moutsouris sign for graft orientation.
- Intraoperative OCT.
    - Advantages: orientation confirmation, saves endothelial cells and reduces epithelial removal.

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9. Intraoperative Complications

Fibrin reaction

- Major surgical obstacle.
- Makes graft rigid and immobile.

Management:

- If severe → surgery may fail.
- If partial attachment:
    - Wait several days.
    - Perform rebubbling later.

Vitreous in anterior chamber

Management:

- Anterior vitrectomy.

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10. Postoperative Outcomes in Complex Cases

Compared with standard DMEK (e.g., Fuchs dystrophy):

- Longer surgical time.
- More manipulation.
- Higher endothelial cell loss.
- Lower graft survival.

Example data:

- **≈70% graft survival at 2 years** in some high-risk groups.

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11. Patient Counseling

Patients should be informed that:

- Surgery is technically more difficult.
- Multiple procedures may be required.
- Graft replacement may be necessary.

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12. Alternative Surgical Options

DSEK

- Still useful in very difficult cases, especially for surgeons experienced with the technique.

PKP

- Used when lamellar techniques fail.

EndoArt (artificial endothelium)

Limitations: high complication rates, endophthalmitis, detachment problems.

Experimental options

- Cell injections
- DSO / DWEK

Not suitable for most complex cases.

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13. Practical Tips for Challenging DMEK

- Use older donors (=loose rolls), avoid tight graft rolls.
- Create enough anterior chamber space.
- Ensure a stable diaphragm.
- Release adhesions carefully.
- Use SF6 gas in difficult cases.
- Improve visualization with staining and OCT.

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14. Training and Surgical Experience

Suggested experience before complex cases:

- **50–100 standard DMEK surgeries**.

Surgeons should master:

- Descemetorhexis, graft loading, orientation, unfolding techniques.

Final Take-Home Message

- DMEK is feasible in the vast majority of cases, even complex ones.
- Success depends on:
    - Careful donor selection.
    - Creating adequate surgical space.
    - Stable anterior segment anatomy.
    - Experienced surgical technique.
- Alternative techniques like DSEK or PKP remain important backup options.