

How to tame a tight DMEK roll?

Young donor tissue can be a challenge for DMEK in both preparation and surgery. Process improvements and expert tips can help to meet these challenges so that this tissue is used optimally.

Challenges in preparation of an isolated DMEK roll

- Difficult to detach due to strongly adhered and thin Descemet membranes
- Tendency to tear when manipulated
- Complicated microscopic evaluation due to multiple cell layers

Tips for 'no touch' preparation:

Peripheral loosening

- Hold the scleral rim firmly at the 12:00 o'clock position
- Use a hockey stick with downward pressure in stroma
- Leave the trabecular meshwork attached to the membrane
- Cut thicker fibers peripherally

Strip

1. Check whether the membrane is loose all around the periphery and, if necessary, stain it with Trypan blue
2. Strip slowly with horizontally placed McPherson forceps
3. Keep the attachment line clearly visible and avoid tears

Trephination and evaluation

- Move the membrane onto the contact lens. Use liquid, soft-touch sponge (spear) and forceps to flatten the membrane
- After trephination, it spontaneously forms a tight roll in saline solution
- Make into a double roll for easier microscopic evaluation

Results

- Maximum use of young donor tissue
- Success rate was >90%
- Higher endothelial cell density
- Double rolls usually remained double until surgery

Discussion

- The 'pneumatic dissection' technique may be a more efficient dissection method.
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Challenges during surgery with a tight DMEK roll

- Difficult to unfold and center
- Risk of rotation to incorrect upside-down position
- Possibly higher chance of detachment due to elastic force

Two approaches have been presented to address these challenges:

1. Creating a double roll
2. Reducing the elasticity of the role



1: Double roll

There are several known techniques for creating a double roll. Recently, the 'Bubble-in-the-roll' technique has been introduced, in which air is injected into the roll using a 30-gauge Rycroft cannula, causing it to open symmetrically and form a double roll.

Advantages:

- Simple and effective
- High success rate
- Shorter surgery time and possibly less endothelial cell loss (preliminary data)

Impact and recommendations

- Makes the use of younger, tighter rolls feasible
- Ideal for starting DMEK surgeons and corneal fellows
- The technique has received international attention and is already being used successfully by fellow ophthalmologists

Practical tips for operating with a double (tight) DMEK roll

- Rinse more thoroughly to remove transport medium
- Re-staining the roll is sometimes necessary after manipulation
- Air bubbles in the roll can be removed with BSS bursts
- Use a narrow cartridge to prevent rollback

Discussion

- Using a narrow injector is difficult with a deep or unstable anterior chamber.
 - The tissue characteristics do not change. Ideally, a young donor roll will have the elasticity of an older one.
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2: Reducing elasticity

Elasticity of the graft is determined by the Descemet membrane, which is composed of glycoproteins, proteoglycans, collagen and elastin fibers. The elasticity is higher in young donor tissue.

Research of enzymes

A study investigated the use of proteolytic enzymes to reduce the elasticity of rolls. The elasticity was measured by the Maximum Scroll Width.

- Collagenase IV: Showed some decrease in elasticity, but results were inconsistent.
- Other enzymes, such as elastase and hyaluronidase, showed no obvious or even negative effects.

Conclusion: Results were inconsistent, but enzymes appeared to be relatively safe. More research may be useful.

Research into storage duration

A study analyzed the effect of cold storage (Optisol-GS) on roll elasticity:

- Rolls stored for a longer time (1 week) were less elastic than rolls stored for a shorter time (12 hours).
- Elasticity was not dependent on age, endothelial cell count, or time between death and first preparation.

Conclusion: Longer cooling in cold storage can reduce elasticity.



Discussion

- Atomic Force Microscopy (AFM) as possible alternative to Maximal Scroll width determination, although less suitable for large-scale research.
- Opening a tight roll several times reduces the elasticity of the graft. However, 'aggressive' handling of a transplant can cause damage.
- Fibrin formation around a DMEK graft sometimes occurs due to irritation of the iris by repeated tapping, especially with tight rolls that are difficult to unfold.

Preventive measures:

- Use of enoxaparin
- Application of Tissue Plasminogen Activator (TPA)
- Avoid blood in the anterior chamber

