Course 08-407  DMEK from D to K: Step-by-Step Approach to Descemet Membrane Endothelial Keratoplasty
University of Toronto
University of Ottawa

Introduction

• Speakers
• Outline
  – Transition to DMEK
  – Tissue Preparation
  – Injection and Unfolding
  – Complications
  – Complex situations

Transitioning to DMEK

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Why Transition to DMEK?

- Better visual outcomes
  - Early
  - Smaller incisions
  - Predictable
- Lower rejection rates
- Minimal up front costs

Barriers

- New technique
- Steep learning curve
- Tissue preparation challenges
- Tissue insertion challenge
- Volumes

Change

- No convenient time
- Set a date
- Have an action plan
- Track outcomes and respond
Steps for Success

- Watch videos
- Structured learning
- Standardize technique
- Practice donor preparation on your own

Volumes

- Surgeon dependent

"Some surgeons can do one or two DMEKs a month and be very good at it. Others will have a miserable time reaching and maintaining the necessary skill level with only one or two cases a month. Only the surgeon can make that decision. But if you want to offer DMEK, you have to commit to going through the learning curve."

- See more at: http://www.reviewofophthalmology.com/content/11/2996/e/c50329/8/87hash/UnrgMb9Y.dpuf

Dr. Mark Terry
Ideal early case selection

- Pseudophakic
- Fuchs
- Normal pupillary response
- Favourable Donor – >65 years
- No combined cases
- No pseudophakic bullous keratopathy
- No previous vitrectomy

Prepare the Donor tissue day(s) before surgery

- Prepare tissue 90%
- Takes the stress away

Video
Tissue Preparation: Toronto

1. Stain for 15 seconds VB
2. Divide TM
3. Disinsert Schwalbe’s line
4. Peel into Taco
5. Punch with 2-3 mm punch
6. Mark stroma with “F.”
7. Punch DM with 7.5-8.5 mm

Tissue Preparation: Toronto

8. Secondary peel
9. Stain 1 minute VB
10. Irrigate scroll
11. Aspirate into Injector
Injectors

Alcon Injector

Alcon cartridge injector
Gueder Glass Injector

Tissue Preparation: OTTAWA

Kashif Baig

Double Trephination Method

- First trephination: 10 mm
- Finding DM - Stromal plane
- Partial DM stripping
- Second trephination: 8 mm
- Graft Marking
- DM stripping completion
Tissue preparation, Marking and Loading: Alternative methods

Mauricio Perez

Tissue Preparation Problems: Prevention & Management

Mauricio Perez

Tips: 360 degrees dissection

- Use forceps with wide area of contact to distribute tension and avoid ripping the donor
- Start from an area where you are sure there are no tears
- Maintain the plane of dissection horizontal to the starting point (do not modify the Z axis)
- Be aware of traction lines from peripheral attachments
- 50-60% stripping is enough to move to the next step
Tips: Tears

- Peripheral circumferential tears are not game changing
- Include the tear into your grab and continue your dissection
- Aim is to avoid converting them into radial tears

Tips: Tears

- Rescue:
  - Stop dissection in that area, and restart in different quadrant
  - If all quadrants have tears, try freeing at least one spot within the final donor size. Trephinate and start dissection from that spot
  - Centre final trephination to avoid a particular radial tear
  - Donors with minor peripheral tears can still be used

Problems

- Two 360 degrees peripheral attachments:
  - Scleral Spur: external, strong & thick
  - Schwalbe’s Line: internal & weak
Problems

• Scleral Spur attachment:
  – Creates radial traction, leading to tears
  – Creates different planes: deep & superficial
    (behind and in front of scleral spur)
  – Can leaves tags attached to donor during
dissection

Alternatives

• Start dissection in front of scleral
  spur
• Remove tags during dissection
• Become familiar with different
  planes: not too deep, not too
  superficial
• Survive through the tears, and
decenter trephination

Scleral
Spurectomy

• Manual dissection of Scleral Spur prior to
dissection
  – Quick, easy, & reproducible maneuver
  – Eliminates radial traction created by Scleral
    Spur
  – Can reduce or eliminate appearance of tears
    if you are experiencing them
  – Can make DMEK tissue preparation easier and
    more reproducible for the beginning surgeon
Scleral Spurectomy

- Recommended for:
  - Transitioning into DMEK
  - Experiencing high rate of tears
  - Friable tissue
  - Difficulties finding plane of dissection in front of scleral spur

Tips:

Trephination

- Avoid block holes while punching the stroma to avoid stromal tags
- Make sure you are punching within the area of the final graft
- Pick a letter that is not confusing (currently using an F followed by a dot)
- Drying the area before and after marking is key for the mark to stay during insertion

Tips: Incomplete Trephination

- If corneal window is incomplete, complete with Vannas from EPITHELIAL side, away from DM
- Donor with small defects, even central ones, can still be used. Endothelial cells will migrate and cover the defect
Tips: Full-thickness Trephination

- Rescue
  - Apply countertraction with second forceps
  - Easier to reposition peripheral scleral rim than attempt dry dissection

Tips: Trephination

- Takes some wetlab work to feel the exact amount of pressure for trephination
  - Too much: full thickness
  - Too little: incomplete trephination
- Easier to deal with full thickness than with incomplete trephination

Tips: Final Strip

- Use a few drops of TB and make sure the trephination is complete over the 360 degrees (use a forceps to check the edge of trephination)
- Complete the remaining 40% of dissection with a capsulorhexis like motion
Tips: Scroll preparation

• Stain with TB for AT LEAST 1 minute
• Try to achieve either a double or a symmetrical single scroll
• Plan your insertion based on the position of the donor graft inside the injector

Tips: Loading the Graft

• When using plastic injector or the modified Jones, use as little aspiration as possible
• When using a Geuder injector, do not use any aspiration at all. Trap donor graft by positioning injector around it

Tips: Loading the Graft

• DO NOT touch the BSS on the corneoscleral rim while dropping BSS drops to modify tissue configuration
• Request big scleral rims to prevent donor tissue migration from the workspace
Tips: Loading the Graft

• Make sure the graft is not close to the tube opening.
• Make sure there is no air at the tip of the tube, otherwise that air will go to the AC as well.
  – Don’t push the graft away to get rid of the air!
  – Use the cannula to put more fluid into the tube and the air will go away

Upper triangle sign (UTS)

Symmetrical single scroll

Tips

• Triple orientation check:
  – Anterior UTS inside the injector before insertion
  – Posterior UTS inside the injector during insertion
  – Anterior UTS outside the injector at the end of the insertion
• Rotate your wrist accordingly
DMEK Injection and unfolding:
Toronto
Mario Saldanha

Ready to inject!

- Verify the orientation
- Glass injector–tap
- Alcon “C” or “D” Cartridge, the graft is already at the tip.

Verify the orientation - video
Orientation

Injection

• Stabilize the eye
• Bevel down on insertion
• Slow entry into the AC
• Clamp AC maintainer
• Once just past the pupil
• TURN THE BEVEL TO THE DESIRABLE ORIENTATION

Injection

• Shallow AC via paracentesis
• Inject slowly insert distal end into opposite angle
• Prevent backflow into the injector or out of the eye
• Tissue outside injector
• Bevel down withdrawing
Pearls

a) ENTER BEVEL DOWN INTO THE AC

b) ORIENT INJECTION BEVEL TO HOW YOU WANT IT TO COME OUT AND TO UNFOLD

c) ENSURE TISSUE IS OUT OF INJECTOR BEFORE WITHDRAWING

d) ALWAYS WITHDRAW BEVEL DOWN

video

Moutsouris sign

Moutsouris at al
Unfolding

- Deepen or flatten AC with BSS
- Transplant partially unfolds
- Position the transplant in the center
- Adjust the position of the graft
- Tapping at the limbus opposite

Tapping Scrolls

- Scrolls can be - a) tube b) double scroll c) triangle d) upside down

- Some described techniques :-
  a. Yoerhuek
  b. Dapena
  c. Flushing
  d. Dirisamer

Tapping

- Create fluid waves,
- Fluttering of the edge,
- If upside down, quick flush of BSS
- Or it may shoot it into the angle
- Tapping on the outside at the limbus
Video – double scroll
  • No touch technique – Yoeruek

Very deep Chamber

Shallow
Very Shallow: prevents scrolling

To Center Membrane

DM Scroll – tube or tight scroll

- Inject BSS or flush at right angles to the orientation of the scroll and it will open the right way.
Triangle fold

Very deep Chamber Flip Over

To Position Membrane

Slowly inject air bubble
Full Air Fill, Low Pressure

Air or SF6 - Video

DMEK Injection and unfolding:
Ottawa variations

Kashif Baig
Pearls

• Check orientation of graft,
• Minimise trauma to the endothelium,
• Endothelium is on the outside,
• Shallow the AC enough
• Use a variety of tapping techniques,
• Try and match up donor and recipient edges,
• Top-up air or 20% SF6 on a 30 gauge needle.

Insertion

• Vision blue staining
• Double scroll
• Modified Jones tube
• 3 mm corneal wound
• Protect corneal wound and change graft
  orientation before modified Jones tube removal
• Suture the wound

Intraocular Management

• Central tapping to open the graft
• Anterior chamber decompression to open / move graft
• Scleral / limbal tapping to move the open graft
• Baig’s unscroller: a good option in young donors / tight scrolls
Complications of injection and unfolding

Zach Ashkenazy
Randall Ulate

Common causes for injection complications
• Insufficient incision wound size
• Wound too large
• High IOP
• Dilated pupil
• Injector beveled up

Complications of tissue injection
• Graft injected outside of the A/C
• Graft escapes the A/C through main incision
• Graft retracts back into the injector
• Graft is injected behind the iris
• Graft is upside down
**Preventive steps**

- Always ensure proper graft marking
- Create proper incision size and construction to allow injector to be fully inserted into the a/c and water tightness
- Always inject and pull out with the bevel down
- Use an A/C maintainer on lowest setting for the injection step

**Preventive steps**

- Slide the injector across the pupil to avoid injection behind the iris
- Reduce a/c pressure before pulling injector out and apply pressure on incision upper lip
- Constrict the pupil before injection, when doing a triple procedure make sure there is no dilating agent in the BSS bag
Rebubble, Post op Management, Hemi-DMEK

Javiera Compan

- Full air fill for 1 hour
- BSS / Air exchange
- Patient leaves with air

Residual air bubble 1 day after DMEK

AS-OCTs
- Essential for DMEK surgeon
- Serial AS-OCTs to
Completely detached scroll

Compression of scroll just before blink

Observe peripheral detachments

Re-bubble larger detachments

Peri-Operative Management

After Surgery:
- Prednisolone 1% qid x 4 mo, tid x 1 mo, bid x 1 mo, maintain at qd, and then FML after 1 yr
- Sutures removed at 2 weeks
- Refraction at 3 months
- Endothelial cell counts yearly
Complex cases DMEK phaco

Neera Singal

Advantages

• Single surgery
  – Less risk
  – Less cost

• No significant adverse outcomes
  – Detachment rates similar

Technique

• No preop dilation drops
  – Intracameral phenylephrine + michol for pupil management

• Cohesive only. No dispersives

• Smaller size of rhexis

• AC maintainer is optional
Complex cases: Post Trab/Tubes Post vitrectomy
David Rootman

TUBES/TRABS
- Trim tube if long
- Full gas fill in AC
- Have PI
- Low pressure fill
- Great cases for DMEK
Complex cases: Post DSAEK/PKP

Kashif Baig

DMEK post PKP

Key points

– Undersize DMEK graft 1mm smaller than PKP
– Consider doing AS-OCT to assess graft-host junction of PKP
– May be difficult to strip Descemet's membrane
– Suture wound

DMEK post DSEK

Key points

– View often improved once failed DSAEK graft removed
– Peripheral edge of DSAEK graft is adherent to host cornea, central area is not
– Make sure no host Descemet's membrane tags are present