The Fine Art of Descemet’s Membrane Endothelial Keratoplasty

I. When you start talk to the eyebank
   A. Consider getting pre-harvested DMEK tissue
      1. You can get the S-stamp that shows orientation
         a) Gentian Violet ink mark Descemets side of DEC
         b) Invented by eye bank tech Philip Dye
         c) Some times older tissue has minimal curling
      2. Extra charge for tissue is pass-through
      3. If you damage the tissue you may have to pay for it.
   B. If you harvest the tissue yourself, make pre-
      arrangements about tissue lost to harvesting the Descemet’s
      endothelial complex
   C. AGE of donor tissue is important
      1. Younger tissue
         a) Rolls up tighter
         b) Harder to unfold
c) More elastic and more peripheral scrolling
d) More likely to detach

2. Older tissue
   a) Rolls up more loosely
   b) Unfolds easier
   c) More rigid less elastic Easier to unfold/unroll
d) Ideal to donor age to start with is 50-70 year old

I (1) many times unrolls spontaneously

II. Harvesting the Descemet’s Endothelial Complex (DEC)

A. Using the SCUBA (Giebel) technique
   1. Can use the chamber (eyebank) the donor cornea comes
      a. provides a better view of the edge of unstained tissue
   2. Can use the teflon trepine block (Barron Donor or Hanna)
   3. Trypan blue facilitates the view of the edge of Descemet’s Tapered dull instrument (sinsky hook) to score Descemet’s anterior to the angle structures.
      a. note the corneal diameter to make sure your donor is large enough

B. Staining the cornea with Trypan blue
   i. Can be repeated several times during the Harvest.
   ii. Helps you see the edge of the tissue
   iii. See defects in the tissue -- stress lines, cell dropout
1. I have rejected tissue based on large areas of cell drop out
   
   b. Using a tapered dull tipped instrument to separate Descemet’s from the stroma 360 degrees

   i. Moria microfinger

   C. Remove tags that can radialize --tying forceps

   D. Peeling the Descemet’s in quadrants (see figure)

      a. can avoid a problem area and leave till after trepination

   E. Trepine partial or full thickness through donor button

      1. Make sure to measure the recipient bed prior to trephining the donor tissue

      2. Hanna donor trepine punch

      3. Barron donor vacuum trepine punch

II. Placing the membrane in the injection system --

   A. Trephine the DEC to the appropriate size

      1. Beware of RECIPIENT corneal diameter and arcus

      2. Larger diameter grafts may have more peripheral lefting/scrolling

   B. Larger diameter grafts may be more affected by donor recipient curvature mismatch

   C. Place DEC in undiluted Trypan blue in the corneal button or petri dish to soak

      1. 60 seconds (optimum time unknown)
2. Make sure the dye gets into the lumen of the roll

D. Melles glass tube
   1. My preferred injection system
   2. Goes through a 2.4 mm incision
   3. Can drop the tissue into large end or draw it into the large end with syringe.

E. Many IOL injectors can be adapted
   1. Hooked up to tubing and syringe
   2. Staining the DEC with Trypan blue
   3. Placing the DEC into the cartridge
      a) Care with surface tension
      b) Push the membrane as far into the cartridge as possible
      c) Connect the tubing use fluid to inject the tissue

II. Harvesting/Removing the Recipient DEC
   A. Corneal Diameter is important
   B. Consider epithelial debridement
   C. Arcus
      a) Blocks the view of the peripheral edge of the DEC
   D. Role of viable peripheral endothelial cells
      a) Stem cells
      b) Can be relatively clear cornea free from gutatta
   E. Match the diameter with that of your donor DEC
   F. May prevent peripheral clefting or scrolling
G. Using air or viscoelastic (must be thoroughly removed)
   1. I use a 60 cc syringe with an AC maintainer
      a) fine silicone tube
      b) attached to a 25 guage nonserrated maintainer
      c) Assistant can gently refill the chamber

H. Identify tags of Descemet’s
   1. Easier to see under air
   2. Trypan blue may help

I. Consider making a peripheral iridotomy inferiorly
   1. Can use a bent needle and sinksy technique
   2. Can do with a YAG laser before

III. The clear corneal wound
   A. Match to the size of your cartridge
   B. Place a suture as soon as the membrane is inside the eye
      1. Preventing prolapse of the tissue through the wound

IV. Injecting the membrane into the eye
   A. Make sure the cartridge is completely within the eye
   B. Use gentle pulses of fluid
      1. Care to avoid over-inflating the eye
a) The eye has to be firm to allow insertion of the cartridge
b) There has to be some leak
c) Can drain fluid out through paracentesis
d) Avoid allowing the membrane to prolapse through the wound around the cartridge

C. Consider making sure the membrane will move inside the cartridge prior to engaging cartridge in the wound

V. Unfolding the DEC

A. Key Principles

1. Which WAY is up or down
   a. The endothelium is ALWAYS on the outside of the roll
   b. S-mark with prepared tissue
c. Making small marks on the periphery of the DEC tissue
   (1) Using a skin punch or Kelly’s Descemet punch
d. The blue cannula sign
e. Using a slit lamp: hand held or attachment to the microscope

   i. A deep anterior chamber facilitates flipping or rolling over the DEC, but the DEC tends to roll into a scroll
   ii. A shallow anterior chamber facilitates unrolling or flattening the DEC scroll, but difficult to flip or roll over
   iii. Try to get the “Minuteman” sign or “Bermuda triangle” (see figure) or a double scroll
   iv. BEWARE of arcus (size tissue!)
      1. Choose a smaller diameter graft tissue
v. Using the bubble on top or underneath
vi. Use the cannulas on top to massage the cornea

VI. To fill or not to fill

B. Total air fill for one to two hours
   1. Make sure the air goes into the right space
   2. Avoid “fisheggs”
   3. Air beyond the edge of the donor tissue
   4. Question of time
   5. Trend to use SF6 gas 15-20%

C. Slit lamp nearby
   1. Check the bubble size
   2. Check the edges of the graft prior to discharging the patient
   3. Prevent pupillary block
      a) Check the IOP
         (1) Complete air fill with inferior PI
            (a) not a guarantee there will be no pupillary block
         (2) Dilate with bubble clearing pupil margin
            (a) use atropine or longer acting agent
            (b) Possibly occlude small iridotomy
      b) ? role of diamox

VI. Post-operative Management

A. Complete dislocation is rare
   1. Role for retaining sutures inferiorly

B. Looking for the graft
1. Look for the edge (see figure)  
2. False reflections  
3. Looking for clefts  
   a) The membrane rolls anteriorly (see figure)  
C. Using the anterior segment OCT  
1. Not essential  
2. Can identify the clefts or channels  
3. Patient education  
D. Importance of channels/folds in the DEC  
1. Clefts allowing fluid migration centrally  
E. Pachymetry  

VII. The decision to re-bubble  
A. Is the DEC roll visually significant?  
B. Is there central edema?  
C. Is there a risk the donor tissue can dislodge?  
D. Re-bubble Rate is decreasing  
1. Largely depends on tolerance for peripheral rolls  
2. Urgent re-bubble  
   a) iris touch  
   b) risk of donor detachment  
   c) greater than 90 degree angle of scroll  
      (1) If limited or small can leave it  
3. Done in the office  
   a) Povidone Iodide 5% drops
b) Tetracaine/Occasionally 2% lido with epi subconj

c) Lid speculum

d) Bent 30 Guage needle
   (1) Make sure the air goes into the right space
   (2) Avoid “fisheggs” --multiple bubbles

e) Supine for 30-60 minutes +/- dilation

E. The role of the age of the donor tissue
1. Younger donor tissue may need more frequent exams and increased risk of re-bubble

F. Caution against early removal of air

VIII. How quickly does the vision improve
A. Curvature mismatch
B. Depends on how long the cornea was swollen

1. Epithelial haze
2. Stromal Haze
   a) Subepithelial Scarring
   b) Diffuse stromal clouding
C. Sometimes superficial keratectomy (epithelial debridement) needs to be performed

IX. Use of steroids
   A. Decreased rejection risk

X. Removing the suture and refraction
A. Remove suture at one to two weeks
   1. Problem with re-bubbling -- air can escape through wound 
   2. Refraction can be done at one month 
B. Small hyperopic shift 
   1. Due to the increased refractive index of a swollen cornea 
      a) Central cornea thins 

XI. Endothelial Density 
   A. Redistribution of cells