AN OVERVIEW OF EYE BANK PRECUT TISSUE FOR ENDOTHELIAL KERATOPLASTY

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Chairman, Vision Share EK Technology Group
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Objectives

- Observers of this presentation should have a good general understanding of the mechanics of precutting
- Specific tricks, tips and techniques will be described
- Tissue selection and evaluation will be discussed
Tissue Selection

- Adequate rim size (too small, too big)
- Adequate endothelium
- LASIK, PRK is OKAY (leave the Epi ON for measurement of thickness)\textsuperscript{1,2}
- Extremely edematous tissues may be too thick to get a thin graft, may cause irregular graft
- Watch out for thinning at the site of IOL scars
- Watch out for glaucoma blebs/surgery
- Avoid excess conjunctiva attachments as they can stick out of the chamber and cause irregular cuts or adhesions post-cut
Benefits of Precut Tissue

- Expanded Donor Pool (2-3%)
- Can centralize costs of expensive equipment acquisitions
- Quality can be checked prior to tissue use with slit lamp and specular microscopy (and OCT)
- Technicians can become extremely proficient at the procedure due to high volumes of procedures thus enabling more consistent outcomes (e.g. bed size, graft thickness)
- OR time is saved
  - No “surprises” when tissue is ruined
  - Less time spent by surgeon preparing tissue
Costs of Precut Tissue

- Lost tissue due to failed cuts can not be reimbursed (approximately 1% failure rate)
- Capital expenditures for expensive equipment
- Increased costs of consumables
- Increased staffing to handle additional burdens of cutting, tissue evaluation, communication and caring for instruments

Failed Procedures

There were a total of 14 failed cutting procedures, representing 1.5% of all attempted procedures. The rate of failure was highest in the first quarter at 5% (n = 11) and thereafter dropped substantially to ≤0.5% in the remaining 3 quarters (n = 1/quarter). No difference in tissue characteristics such as corneal pachymetry, thickness or ECD was noted among the failed tissues. Neither was there evidence of

Communication is Essential

OPERATIONS

Cornea Request Form

LIONS EYE BANK of OREGON

CORNEA REQUEST

Date of Request ____________  All requests must be FAXED

The cornea which you are requesting requires that we obtain certain information about the patient so that we may accurately maintain our waiting list and adequately track the donor’s cornea, especially if your patient were to experience an adverse reaction following the transplantation. Please complete the information below and fax to us when making your request. Thank you for your cooperation.

<table>
<thead>
<tr>
<th>Surgery</th>
<th>Tissue Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALKP</td>
<td>Lamellar quality cornea</td>
</tr>
<tr>
<td>KLAL</td>
<td>1 cornea with conjunctiva</td>
</tr>
<tr>
<td>PK</td>
<td>No special requirements</td>
</tr>
<tr>
<td>DLEK/DSEK</td>
<td>Large rim for surgeon dissection</td>
</tr>
<tr>
<td>DSAEK</td>
<td>Eye bank prepared tissue</td>
</tr>
<tr>
<td>IK</td>
<td>zigzag</td>
</tr>
<tr>
<td></td>
<td>A</td>
</tr>
</tbody>
</table>

PATIENT INFORMATION - PLEASE PRINT LEGIBLY

Patient’s Name ____________________________ Sex _______ Race _______

Date of Birth ____________ Age ________ SSN or M.R.Number ____________
**Measurement of Rim Diameter**

Rim size is critical to the success of endothelial keratoplasty due to limitations of artificial anterior chambers. A minimum of 1.5 millimeter rim width and 1.6 mm rim diameter is needed to successfully mount tissue on an artificial anterior chamber. LEBO routinely measures the rims and records this information on LA17. Using a standard ophthalmic caliper, measure the posterior aspects of the corneoscleral rim:

- a. minimum scleral
- b. maximum scleral
- c. minimum rim diameter
- d. maximum rim diameter

Record measurements a and b as a ranges are reported to the potential

**Sample Rim Measurement:**

![Image of a rim measurement diagram]

**Corneal Evaluation**

<table>
<thead>
<tr>
<th>Exposure Degree</th>
<th>Elementary</th>
<th>Location</th>
<th>Scleral Description</th>
<th>Scleral Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exposure Location</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scleral Location</td>
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<td></td>
</tr>
<tr>
<td>Other</td>
<td>O</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Arcus: O [None]
- Clear zone: [mm]
- Edema Degree: O [None]
- Edema Location: O [None]
- Surgical Scars: O [IOL]
- Anterior Scars/Other: [ ]

- Desc. Mem.: O [None]
- Folding Quantity: O [None]
- Folding Degree: O [None]
- Other: [None]

- Street Lines: O [None]
- Street Lines Location: [ ]

**Tissue Evaluation**

- Cell Count: 2,941
- Lens Status: Phakic
- Aseptic of Arcus: +6 mm

**Epithelium:** Exposure Degree: Mild-Mod, Diffuse
- Scleral Description: Early, Sclerotic Location: Patchy
- Other: Small (<5mm) epi tear: 7 mm

- Endothelium: Other: Rare stress line at limbus

**Rim Measurement:**

- Rim Width (mm): 3.64
- Rim Diameter (mm): 18.19
Using common language
Documentation

- All significant steps are carefully documented
- Documentation is performed concurrently with the work performed to ensure that nothing is missed
- The circulator’s job is essential to consistent high quality
Field Set-up

- Set up field according to E1.005
- Circulator shall don a mask and cap for this procedure
- Documentation of sterile supplies and procedure set-up occurs on the Critical Supplies Checklist
BSS Flow

- The bottle is raised to the height of the 55 inches from the sterile field.
- The line is opened once the operator has flow directed to a medicine cup.
- The line is bled of ALL bubbles.

Port must be OPEN.
Meticulous Attention to Details are ESSENTIAL
Photos of proper mounting of the tissue
Helmet on

- Place the helmet on the chamber so that the guidepost is positioned appropriately for a right-handed pass (at 3 O'clock)
- Raise the piston
  - Check centration before the piston is completely raised, make final adjustments if needed
  - Ensure that there is no conjunctiva escaping from helmet opening
- Lock the helmet in place
Centered and Mounted Tissue
Pressure Check!

- The stopcock is opened to the BSS pressure
- Pressure can be verified with light tactile pressure from a gloved finger or with a newel sponge.
- Next remove the epithelium with a surgical spear, check the pressure prior to epi removal or risk damage to the endothelium
Epi removal/Orientation Marking

- Use a spear to remove as much epithelium as possible
- Apply gentle pressure to the wexel sponge
Make an Alignment Mark

- Mark the cut exit with a small linear gentian violet mark radiating from the limbus centrally for approximately 2-3mm.
- Make the mark at 6 O’Clock
Pachymetry

Place the pachymeter probe perpendicular to the corneal surface and gently touch the surface with the probe.
Variables of Obtaining the Desired Graft Thickness

- Pressure
- Head Size
- Speed of the pass
Pressure

- Pressure should remain relatively constant throughout the cut.
- Performing safety checks will ensure proper pressure is maintained throughout the cut.
Pressure Continued

- Recall that the bottle height is constant
- The placement of the roller stopcock and the hemostat is constant
- If the height of the bottle is lowered, so does pressure
- If the IV line is compressed by a larger hemostat, the pressure will rise
- To minimize variability in the cut, DO NOT ALTER THESE PARAMETERS
# Head Size

<table>
<thead>
<tr>
<th>Head Size</th>
<th>Cap Thickness</th>
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<tbody>
<tr>
<td>250</td>
<td>270</td>
</tr>
<tr>
<td>300</td>
<td>330</td>
</tr>
<tr>
<td>350</td>
<td>380</td>
</tr>
<tr>
<td>400</td>
<td>450</td>
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</table>

<table>
<thead>
<tr>
<th>Cornea Thickness</th>
<th>Graft Thickness</th>
<th>Head Used</th>
<th>Graft Thickness</th>
<th>Head Used</th>
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</thead>
<tbody>
<tr>
<td>600</td>
<td>150</td>
<td>400</td>
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<td>400</td>
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<td>475</td>
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<tr>
<td>400</td>
<td>150</td>
<td>250</td>
<td>100</td>
<td>300</td>
</tr>
</tbody>
</table>
Speed of the Pass for 150 Micron Graft

- Which head do you choose if the cornea is 500 microns thick?
- A 300 Head will leave a 170 graft, a 350 Head will leave a 130 micron graft
- That means… We can speed up the pass with 350 Head and we can slow it down with a 300 Head to achieve basically the same results
Thus... There is an Art to this Science of Precutting!!
The PASS- Final Preparation

- Double check all connections to ensure no loss of pressure occurs and that all equipment is securely tightened.
- Place a few drops of BSS on the cornea for lubrication of the pass.
Test the microkeratome

- Carefully load the head with a fresh blade
- Run the microkeratome in BSS for a few seconds to test the equipment and free any debris from the blade
Interface Debris is Real
A couple of things before the cut

- High pressure, stopcock rolled forward
- Hemostat engaged
- Take a deep breath
Remove the cap from the keratome head

- Open the roller stopcock
- Remove the tissue forward so that the cap will not be cut by the blade
- Place the cap on a lint free surface for later use
Measure the graft thickness

- Take a pachymeter reading of the graft bed. Use extreme care not to apply inadvertent pressure to the tissue.
- A small amount of BSS may assist with the measurement.
- At this time, a graft orientation mark may be made.
Replace the cap

- Place a couple drops of BSS on the graft to minimize bubble formation
- Place the cap back on the graft bed so that the two alignment marks are re-apposed
- Wick remaining fluid from the interface with wexcel sponge spears. Get ALL fluid from the interface to ensure proper cap adherence.
Poor wicking causes non-adherent caps
Dismount

- Invert the chamber
- *SLOWLY* turn the adjustment screw to move the cornea away from the helmet
- Once BSS begins flowing freely, the helmet can be completely moved away from the anterior chamber
- Once the helmet is free, the BSS can be turned OFF.
Placement of Cornea in Media
Next Steps

- Break down field, care for instruments
- Paperwork
- Data entry
- Evaluate Tissue
- Surgeon communication
Tissue Evaluation
## EK Prepared Tissue Evaluation

<table>
<thead>
<tr>
<th>Imported From</th>
<th>EB ID#</th>
<th>LEBO ID#</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-Cut</td>
<td>Specular</td>
</tr>
<tr>
<td></td>
<td>Date/Time:</td>
<td>By:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Other Comments:

#### Stroma
- clean & compact
- mild edema
- mild to moderate edema

#### Desemet's Folds
- trace or no folds
- mild folds
- mild to moderate folds

#### Endothelium
- no defects
- mild cell drop out
- mild to moderate cell drop out

### Date/Time: | By: | ES
- Acceptable for EK
- Unacceptable for EK
- Need MD Approval for EK

### MD Eval (if deemed necessary by Eligibility Specialist)
| Date/Time: | By: | Comments:
- Acceptable for EK
- Unacceptable for EK

### Posterior Stroma
- clean & compact
- mild edema
- mild to moderate edema

### Anterior Stroma
- centered, aligned, and aligned with orientation mark(0)

### Descemet's
- trace or no folds
- mild folds
- mild to moderate folds

### Endothelium
- no defects
- mild or no cell drop out

### Epithelium removed during processing
- uniform cut
- uneven cut
- Bed Size (mm):

**S T O C K**

- peripheral
- diffuse
- central

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**Note:**
- The form should be filled out by the appropriate personnel.
- All fields marked with an asterisk (*) are mandatory.
Donor Information

EK Prepared Tissue Report

Date/Time of Death: 12/29/09 11:30
Date/Time of Ocular Cooling: 12/29/09 12:50
Death to Cooling Interval: 60:20
Date/Time of Procurement: 12/29/09 12:19
Death to Procurement Interval: 11:40
Date/Time of Preservation: 12/29/09 12:10
Death to Preservation Interval: 11:40
Date/Time of Processing: 12/30/09 11:28

Procurement by: William Ryan
Prepared for Transport by: Jamey Goss
Prepared for BK by: Edmison, Dr.

POST PREPARATION EVALUATION

Rim Width (mm): 3.0
Rim Diameter (mm): 10.0
Cap Thickness: 560
Anterior Stroma: Unscarred and adherent
Posterior Stroma: Clear and smooth, uniform
Descemets Membrane: Trace folds, no detachments
Endothelium: Mild cell dropout, no stains

General Comments:

Evaluation by: Matt McIlwain
Date of Evaluation: 12/29/2009

PRECAUTIONS

This tissue has been prepared for endothelial keratoplasty using a Moria microkeratome. The standard precautions for tissue may apply (see Design insert for Eye Tissues for Endothelial Tissue). Prior to implantation, the tissue was evaluated with the surgeon. Additional precautions are as follows:

1. The cap has been replaced and should be adherent in order to assure no vascular swelling of the tissue occurs. If the cap has not adhered, the surgeon must determine whether or not it is appropriate to utilize the tissue.
2. Corners should be checked by the surgeon and examined using microscopy. The cornea can be placed on a sterile field and marks quickly applied using care in the retaining the endothelium. The ophthalmic viscosurgical device (OVD) should be applied to the corneal stromal bed. The ophthalmic viscosurgical device is removed after the OVD has been replaced with the corneal graft.
3. In addition to a corneal mark, it is recommended that the surgeon create the cut edges of the graft. Steps 1 and 2 will ensure a properly centered implantation of the graft.

Revised 06/09
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DIS9 EK Prepared Tissue Report
View Anterior Aspect

- Check for cap adherence, alignment and centration
- Use retroillumination to highlight defects in the endothelium
- Look for bubbles in the interface
- Evaluate how much epithelium has been removed
Same cornea viewed from posterior aspect
View Posterior Aspect

- Check for cap adherence again using the fine slit beam
- Use high magnification for evaluation of endothelial defects and cell loss and stress
- Check carefully for graft uniformity and dimensions
- Evaluate edema
- Make notations of anything unusual such as bubbles in the interface
Measure the Graft Diameter

Do not include the area of the bevel in the measurement of the graft diameter.

Measure the graft bed from bevel to bevel.
Examine the Endothelium for Trauma

Cornea A
Cornea A
Not all Tissue should be cut
Normally IOL Scars do not pose a problem as long as the endo is suitable
The thinning at the IOL scar was felt to pose a risk of perforation.
2009-0700.CNOD Cornea “stuck” to AC.
2009-0700.CNOD Cornea “stuck” to AC.
Specular microscopy doesn’t tell the whole story.

2009-0700.CNOD Pre-resection photo

2009-0700.CNOD Post-resection photo
Taken at ~24 hours after resection.
References


Thank you!!

- Jeff Young
- Andrea Gareiss-Lok
- EEBA
- Mark Terry, MD
- Maria Zardoya Martinez and the staff of the Transplant Services Foundation
- The staff of the Lions Eye Bank of Oregon