Understanding DMEK
Physics and Rationale

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Appreciation

- My trusting Patients
- SightLife
- Janet Waterman
- Heather Fraser
- Shannon Moon
- Dave Stanfield, OD
- Sean Coombs, OD
- Reid Mamiya, OD
- Lisa Giebel
- Maddy & Josie Baird
- Bob Ford, MD
- Jeff Ing, MD
- Francis Price, MD
- Marianne Price, PhD
- Gerrit Melles, MD
- James McNeill, MD

Agenda

- Results
  - Optically neutral
  - HOA – higher order aberrations
  - Rejection rates
- Surgical procedure
  - Donor selection – age
  - Cell-cell pressure
  - Thickness
  - Surface tension
  - Pressure differences/fluidics
- Postoperative healing
  - Rigidity vs. elasticity
  - Curvature mismatch – molding
  - Donor size
  - Endothelial pump
  - Endothelial cell sealant

Vision and variables

<table>
<thead>
<tr>
<th>PK</th>
<th>DSAEK</th>
<th>DMEK</th>
</tr>
</thead>
<tbody>
<tr>
<td>20/20 - HM</td>
<td>20/25 - 20/50</td>
<td>20/15 – 20/25</td>
</tr>
<tr>
<td>Sutures+, cut, alignment, …</td>
<td>Stroma, curvature</td>
<td>Curvature</td>
</tr>
</tbody>
</table>

Penetrating - PK

Variables
- Donor/host fit
- Stromal thickness
- Curvature
- Cut
- Alignment
  - Suture tension

Risks
- globe strength
- sutures:
  - astigmatism
  - abscesses
  - adjustments
  - breakage
**Lamellar - DSAEK**

- Variables
  - Donor/host fit
  - Stromal thickness

**Lamellar - (DM)EK**

- Variables
  - Donor/host fit

**DMEK vision**

- REMARKABLE!
- It gets better!

**Optical/Refractive activity**

- DMEK neutral
- DSAEK active

**Stroma irregularities - DSEK**

- LASIK - matched stroma
- DS(A)EK - unmatched stroma

**Higher-Order Aberrations**

- Rudolph et al, March 2012

- Mean f/u 6.5±1.2 months (DMEK), 22.6±11.8 (DSAEK), and 103.1±74.2 (PK)
- DMEK vs. DSAEK … lower HO except coma
- DMEK vs. PK … lower except SA
- BSCVA … DMEK better than DSAEK/PK
- No difference compared to controls
Rejection

2 yr postop 20/30+, IOP 13, diffuse small KP and trace cell

Rejection Risk

<table>
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<tr>
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<th>1yr</th>
<th>2rs</th>
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<tbody>
<tr>
<td>PK</td>
<td>14%</td>
<td>18%</td>
</tr>
<tr>
<td>DSEK</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>DMEK</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

DMEK rejection risk 15x less than DSEK 20x less than PK

Donor Selection - Age

Young
- Higher cell count
- Thinner DM
- More flexible, bendable, elastic

Old
- Lower cell count
- Thicker DM
- More stiff, rigid, inelastic

Elasticity

- Thinner tissue stretches easier

- 10 y/o
- 80 y/o

Surface tension

- High surface tension in water
- Hydrogen interactions
- one of the highest in nature
- \( \text{H}_2\text{O} \sim 73\text{mN/m} \)
- \( \text{Hg} \sim 480\text{mN/m} \)
- Responsible for high boiling point

Surface tension

Dry

Wet

- Harvest – difficult to handle tissue safely unless submerged
- Staining – lifting out of fluid and into trypan blue allows dense staining
- Loading injector – the donor scrolls tightly when lifted into the air
- Unrolling – AC bubbles can help or hinder
- Initial attachment force until endothelial pump kicks in
Pressure differences – fluidics

- If pressure too high inside … risk expulsion or entrapment in wound
- If pressure too low inside … risk going through pupil especially … If
  - large pupil
  - PCIOL
  - zonular defect
  - post vitrectomy
- Care on removing injector

Results - curvature

- Expect great vision within 1-2 weeks
  - Clefting resolved 2 days – 1 month
- Variability depends on curvature mismatch

DMEK Dislocations

- Curvature differences -- rigid, inelastic
  - 30%
- 0%

_DMEK - Art Giebel, MD_
DMEK Clefts
- flatter donor
- steeper donor

Donor size - DMEK
Endothelial pump - DSEK
- Stromal gasket
- Easier to seal, but leaky
- Interferes with vision
- Slower visual recovery

Endothelial pump - DMEK
- No stromal gasket (DSEK)

Postoperative healing
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- Rigidity vs. elasticity
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References

- Visual Quality
References

- Visual quality (cont)

- Rejection

Questions?
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