Understanding DMEK
Physics and Rationale
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ASCRS, Boston

No Financial Interest

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

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

Vision and variables

PK
- 20/20 - HM
- Sutures+, cut, alignment, ...

DSAEK
- 20/25 - 20/50
- Stroma, curvature

DMEK
- 20/15 – 20/25
- Curvature

Penetrating - PK

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

Risks
- Sl 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!

<table>
<thead>
<tr>
<th>Time</th>
<th>% ≥ 20/25</th>
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<tbody>
<tr>
<td>1 wk</td>
<td>29</td>
</tr>
<tr>
<td>1 m</td>
<td>63</td>
</tr>
<tr>
<td>2 m</td>
<td>75</td>
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<tr>
<td>3 m</td>
<td>83</td>
</tr>
<tr>
<td>6 m</td>
<td>100</td>
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**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+2, IOP 13, diffuse small KP and trace cell

Rejection Risk

<table>
<thead>
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<th></th>
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<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>
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<tr>
<td>DMEK</td>
<td>1</td>
<td>1</td>
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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
  ![Elasticity 10 y/o](image)

- 80 y/o
  ![Elasticity 80 y/o](image)

Surface tension

- High surface tension in water
  - Hydrogen interactions
  - one of the highest in nature
    - H₂O ~73mN/m
    - Hg ~480mN/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

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
- Postoperative healing
- Rigidity vs. elasticity

Circulation without apposition
Suction with apposition
Postoperative healing

- Postoperative healing
  - Rigidity vs. elasticity
  - Curvature mismatch - molding

References

- Visual Quality
References

- Visual quality (cont)

- Rejection

Thank You!

Questions?
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DMEK.info