Advancements in Therapeutic Surgical Options for the Cornea
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The cornea is assisted by a tear film and is composed of five layers.

Corneal conditions commonly corrected by surgery

Keratoconus
Stromal dystrophy
Fuch’s Dystrophy
Pseudophakic Bullous Keratopathy

Corneal Grafts are increasing in number

Revolution and Evolution

Corneal Surgery Anatomical Timeline

Here's a patient who…

- Immigrated to the US, and today is his first eye exam
- Is best corrected to 20/80-1 OD and 20/125 OS
- On exam has advanced corneal scarring with corneal opacities and stromal haze
- Pentacam Tomography's look like this
- Pachymetry
- He wants new glasses.

Penetrating Keratoplasty (PK)/(PKP)

- Procedure
  - A circular button-shaped full-thickness section of cornea is removed using a trephine or a laser.
  - A matching button is removed from the donor cornea.
  - The new donor cornea is sewn to the host cornea with sutures.

Post-Operative Course

- Often high amount of irregular astigmatism post-operatively
- Incremental suture removal starting at 3-6 months post-op
- Vision and astigmatism fluctuations on every suture removal
- New glasses at 12-18 months post-op. Likely BCVA with specialty contact lenses
- Steroid Medication

Drawbacks of PK grafts-graft failure

- 10 years post-op 20 years Post-op 23 years post-op
- 11 % 51% 83%

Further Drawbacks of PK grafts-

- Australian registry study
  - most recent follow-up
  - Snellen acuity 20/40 or better in 74%
- AAO registry study→ Achieving 20/40 or better
  - PK’s 39% vs. DALK’s 44%

Comparison of PK vs. DSEK

- Visual Acuity, ECD loss, and Astigmatism
- Acuity >20/40
- Endothelial Cell loss 1 year
- Astigmatism


Deep Anterior Lamellar Keratoplasty- DALK

- Here’s a patient who presents to your office...
  1. He can’t see
  2. His glasses prescription keeps changing
  3. Doctors tell him “His eye is bulging forward.”

Procedure

- Donor graft- Epithelium, Bowman’s, Stroma are dissected out.
- Host- Epithelium, Bowman’s, Stroma are cut out.
- Sutures bring the host and graft together.


DALK vs. PK

- Advantages of DALK
  1) No open globe
  2) Unlikely immune rejection of endothelium
  3) Minor loss of endo cells
  4) Sutures can be removed earlier
  5) Steroids can be stopped earlier

- Major review by AAO for BCVA and preservation of ECD for graft survival
  - 11 large comparative studies
  - 6/11 = BCVA
  - other non-determinant
  - Graft survival at 20 years

PK

51% DALK


Amniotic Membrane Grafts

1. Anti-inflammatory
2. Anti-scarring
3. Anti-angiogenesis (new blood vessel growth)
4. Re-epithelialization

Amniotic Membrane Grafts (AMG)

Biotissue- Prokera, Amniograft, & Amnioguard
IOP Ophthalmics- Ambiodisk

http://www.iopinc.com/store/ambiodisk/
Clinical Usage

1. Insertion Prokera vs. AmbioDisk
2. Time-frame to reabsorption = 10-21 days. Resorption will be faster in neovascularized or very inflammed eyes. More inflammatory cytokines will dissolve the graft faster.
3. Prokera - remove ring in clinic. Ambiodisk - remove BCL

AMG Actions

1. Reduces inflammation
2. Inhibits scarring
3. Inhibits angiogenesis
4. Promotes epithelialization
5. Possesses anti-microbial properties
6. Restoration of lost corneal thickness*

Indications/Conditions for use

- Acute corneal trauma
- Chemical or thermal burn
- Non-healing epithelial defects (herpes, diabetes)
- Neurotrophic corneal ulcers
- Filamentary Keratitis
- Severe Dry Eye Syndrome
- Recurring epithelial defects
- High risk keratoplasty
- Superficial keratectomy
- Tube shunt/bleb exposure
- Pterygium removal

Here’s a patient who...

- Comes into your office because she can’t see
- 57 y/o female
- Complains of blurry vision worse in the morning. Gets better
- Vision “Like looking through water”
- Do I have a cataract?

Konan Endothelial Cell Count (ECC) (ECD-Density)

Unfortunately - This patient’s ECC
Enter DSEK

- Descemet’s Stripping Endothelial Keratoplasty (DSEK/DSAEK)

  Removes
  a. Descemet’s
  b. Endothelium

  Insert
  a. Posterior Stroma
  b. Descemet’s
  c. Endothelium

  Gas/Air bubble tamponades the graft into place

Post-Operative Course

- Post-Op 1 Day → Patient positioning 1st 24-48 hrs
  - Vision 20/200-HM, air/gas bubble covering pupil, IOP normal (ALERT), edematous graft, suture

- Post Op 1 week
  - Vision 20/30-20/100, air/gas bubble gone or nearly, IOP normal, able to visualize graft, mild to no edema, suture

- Post-Op 1 month
  - Vision 20/25-20/50, no bubble, IOP stable, +/- suture, clear graft

- Post-Op 3 months
  - Vision stable = 1 month, ready for new glasses, IOP stable, clear graft.

ALERT

- If bubble is blocking the PI, the PI is non-patent, or bubble behind Iris → patient will be in pupillary block with elevated IOP
  - IOP ranges 30-75
  - Nausea, headache, vomiting.

- Burping the paracentesis or wound will help.

- If these patients call you → Ask them to sit UP.

A Patient with Fuch’s Dystrophy

- Number 1 concern = Glare
  - Vision 20/25 → 20/400

- “I can’t do the things I need to”

- “Scared and nervous”

- Pseudophakic

- His description

The Decision

A. Monitor
B. Muro 128 ointment BID
C. Refer: Endothelial Keratoplasty
D. Look harder for PCO
Introducing DMEK

• Descemet’s Membrane Endothelial Keratoplasty
  • Removes
    a. Descemet’s
    b. Endothelium
  • Insert
    a. Descemet’s
    b. Endothelium

Gas/Air bubble tamponades the graft into place

Post-Operative Course: Similar to DSEK

• Post-Op 1 Day → Patient positioning
  1st 24-48 hrs
  • 20/200-300IM, air/gas bubble covering pupil, IOP normal (ALERT), edematous graft, suture
• Post Op 1 week
  • 20/20-20/100, bubble gone or nearly, IOP normal, able to visualize graft, mild to no edema, suture
• Post-Op 1 month
  • 20/20-20/50, IOP stable, +/- suture
• Post-Op 3 months
  • VA stable, ready 4 new glasses, IOP stable

DMEK +/- Cataract Surgery (Triple Procedure)

DMEK vs. DSEK

DMEK vs. DSEK-Acuity

DMEK vs. DSEK- Pachymetry
DMEK vs. DSEK - ECD

- **DMEK**
  - ECD pre-op: 2575
  - ECD 3 months PO: 2502
  - ECD 6 months PO: 1498

- **DSEK**
  - ECD pre-op: 1778
  - ECD 3 months PO: 1520
  - ECD 6 months PO: 1532

**Risk of Transplant Rejection**

- **Risk of Transplant Rejection at 1 Year**
  - DMEK: 0.7%
  - DSEK: 1%

- **Probability at 2 Years**
  - DMEK: 1%
  - DSEK: 12%

**Graft Adhesion > Sulfur Hexafluoride (SF6) Gas bubbles for lower re-bubble rates**

- **Purple = AIR**
- **Yellow = GAS**

**DMEK vs. DSEK - re-bubbling rate**

- **Discussion:**
  - Although a higher re-bubbling rate for DMEK—no effect on visual outcome or endothelial cell survival rate, but was associated with increased post-operative effort.

**Patients Care About Vision.**

**Visual acuity results better with DMEK than DSAEK at 6 months**


- Six-month data on BCVA were available for 62 eyes in the DSAEK group and 70 eyes in the DMEK group.

- Mean Snellen equivalent BCVA improved from 20/51 preoperatively to 20/32 at 6 months postoperatively in the DSAEK group and from 20/37 to 20/26 in the DMEK group. BCVA differed significantly between the groups preoperatively and postoperatively (both P < 0.01).

- At 6 months, visual acuity was 20/40 or better in 85% of eyes in the DSAEK group and 94% of eyes in the DMEK group. Visual acuity was 20/20 or better in 13% of eyes in the DSAEK group and 46% of eyes in the DMEK group.
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<thead>
<tr>
<th><strong>DMEK</strong></th>
<th><strong>DSEK</strong></th>
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<tbody>
<tr>
<td>♦ Maintains corneal anatomy</td>
<td>♦ Adds thickness to corneal anatomy</td>
</tr>
<tr>
<td>♦ Thinner pachymetry</td>
<td>♦ Equal endothelial cell loss</td>
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<tr>
<td>♦ Equal endothelial cell loss</td>
<td>♦ Re-bubble rates are lower</td>
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<tr>
<td>♦ With SF6 gas re-bubble rates are lowering, and process is safe for patient</td>
<td>♦ Less Travel</td>
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<td>♦ Less graft rejection</td>
<td>♦ Less Visits</td>
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<tr>
<td>♦ Better VISION</td>
<td>♦ Works well for patients with poor visual potential</td>
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