Ultra-Thin DSAEK: The University of Colorado Experience

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Introduction

- Treatment of endothelial dysfunction has been revolutionized over the past 15 years with the popularization of endothelial keratoplasty
- Descemet’s stripping automated endothelial keratoplasty (DSAEK) has become the standard of care but more recently Descemet’s membrane endothelial keratoplasty (DMEK) has been investigated

DMEK vs. DSAEK

- Advantages of DMEK
  - Better and faster visual outcomes
  - Less higher order aberrations
  - Less refractive change
  - Lower rejection rate
- Disadvantages of DMEK
  - Technically difficult insertion
  - Higher dislocation rate
  - More tissue wastage

Problem

- Unexplained visual acuities
- Hyperopic shift
**Question**

- Is there a tissue preparation technique that would provide the low tissue wastage and surgical ease of DSAEK but also the better visual outcomes and lower rejection rate of DMEK?

**Purpose**

- To compare human donor corneal lenticule thickness, endothelial cell viability, area of cell damage and cell count between DSAEK tissue prepared with a double pass microkeratome cut versus the standard single pass.

**Methods**

- Eleven matched pairs of human donor corneas unfit for transplant were used for analysis
- Tissue was prepared using a Moria CB microkeratome and artificial anterior chamber

**Methods**

- One cornea was prepared using the standard single pass cut
  - 300 or 350 micron head
- Second cornea was prepared with a double pass cut
  - 200 or 250 micron head for the first pass
  - Single use 130, 110 or 90 micron head for the second pass

**Methods- Vital Staining**

- 2x Objective 10x Objective
- Stained with trypan blue for 120 seconds and safranin red for 90 seconds

**Methods- ImageJ Micro Analysis**

- Original 0.5mm x 0.5mm area Counted
- Four 0.5mm² areas were counted
- Total of 1mm² for each cornea
- Ratio of non-viable cells to total cell count measured
Results- Thickness (Microns)

- Double pass:
  - Central- 92 +/-20
  - 3mm- 92 +/-23
  - 6mm- 102 +/-25
  - 8mm- 150 +/-29

- Single pass:
  - Central-126 +/-34
  - 3mm- 120 +/-38
  - 6mm-133 +/-45
  - 8mm-179 +/-51

Statistically significant decrease in central thickness in double pass group (p=0.039)
No perforations occurred in either group

Results- Macro Analysis

- Double pass area of cell damage: 1.69 +/-1.07
- Single pass area of cell damage: 1.36 +/-1.18

No statistical difference in area of cell damage between the two groups (p=0.37)

Results- Micro Analysis

- Double pass cell count:
  - 2050 +/-264

- Single pass cell count:
  - 2144 +/-283

No statistical difference in cell count between the two groups (p=0.345)

Results- Micro Analysis

- Double pass ratio of non-viable to total cell count:
  - 0.0145 +/-0.031

- Single pass ratio of non-viable to total cell count:
  - 0.0028 +/-0.0062

Statistically significant increase in non-viable cells in the double pass group (p=0.015)

Conclusions

- DSAEK tissue prepared with this double pass technique was predictably thinner than the standard single pass technique with no increased risk for perforation
- There was a small but significant increased risk for non-viable endothelial cells with no decrease in cell count

Methods- OCT

Double pass

Single Pass
To examine the central corneal thickness, cell density, and visual outcomes of ultra-thin DSAEK grafts in patients undergoing DSAEK surgery.

**Methods**
- Donor cornea is centered on an artificial anterior chamber with a static pressure of 90 mmHg
- Epithelium is removed with a LASIK spear
- CCT is measured and appropriate head size is chosen
- A first pass is made with a Moria microkeratome and the anterior cap is removed
- CCT is measured and the appropriate head size is chosen
- A second pass is made with a Moria microkeratome 180 degrees from the first pass
- The anterior cap is replaced.
- Two surgeons, one eye bank technician
- 10 cases each
- 3 different insertion techniques used
- 14 Mini Busin glide
- 3 Endoserter
- 3 Sheets Glide
- DSAEK grafts were then imaged and measured using a Visante OCT (Zeiss) at 1, 3, and 6 months after surgery
- Uncorrected visual acuity at 1, 2, and 6 months
- Best corrected visual acuity at 6 months

**Results**
- **Central Thickness**
  - Average – 64.9 microns (SD 26.1)
  - Thickest graft – 129 microns
  - 83 microns
  - Thinnest graft – 39 microns
- **Peripheral Thickness**
  - Average – 104.6 microns (SD 26.7)

- **Average uncorrected visual acuity at 1 month**
  - 12 eyes = 20/38
- **Average uncorrected acuity at 3 months**
  - 9 eyes = 20/35
Results

- Average cell density at 6 months
  - 7 eyes = 2184 cells
- Average uncorrected visual acuity at 6 months
  - 7 eyes = 20/32
- Best corrected visual acuity at 6 months
  - 7 eyes = 20/23

Limitations

- Small sample size
- Two surgeons
- Multiple insertion techniques
- Incomplete follow-up

Conclusions

- The double-pass technique for DSAEK donor tissue preparation produces grafts that are consistently thin both centrally and peripherally
  - This was reproducible
  - Can be performed by an eye bank
  - Acceptable cell counts and visual acuity
  - Further study is needed to determine if ultra-thin grafts yield the advantages of DMEK and traditional DSAEK

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