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- Vital Staining

2x Objective

10x Objective

Stained with trypan blue for 120 seconds and alizarin 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
- Graft thickness was measured centrally and 3 mm from center
- Uncorrected visual acuity at 1, 2, and 6 months
- Best corrected visual acuity at 6 months

Results

- CentralThickness
  - 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

Ultra-Thin

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

Acknowledgements

- Michael Taravella, MD
- Aaron Waite, MD
- Shawn Richards, MD
- Francisco LaRosa, MD
- Raul Velez-Montoya, MD
- Rocky Mountain Lions Eye Bank
References


Thank you