Abstract

- **Objective**: Assess 96h shipment of Descemet membrane endothelial keratoplasty (DMEK) grafts as a scroll or tri-fold
- **Hypothesis**: Tri-folded grafts will have a comparable level of endothelial cell loss (ECL) relative to a scrolled graft

Introduction

- DMEK optimizes visual outcomes compared to other variations of corneal transplant techniques
- Preloading tri-folded tissue is proven to decrease surgical time and costs
- Prior studies have only tested the effects of shipping on corneal graft health after 48-72h
- In 2019, over 28,000 corneas were exported internationally from the USA for keratoplasty

Methods

**Experimental groups**
- Scrolled graft in a Jones tube: 10 grafts (A)
- Tri-folded graft in a Treyetech cartridge: 10 grafts (B)

1. **Graft procurement**
   - Corneas recovered by the Rocky Mountain Lions Eye Bank (RMLEB) were used if ineligible for clinical transplantation with consent from next of kin
   - Eye bank technician verified quality of grafts and obtained baseline ECL measurements

2. **Graft peeling**
   - DMEK grafts prepared by eye bank technician according to standard RMLEB procedure

3. **Graft loading and shipping**
   - Scroll method: graft allowed to scroll in media, aspirated into modified Jones Tube
   - Tri-fold method: graft folded with forceps, pulled into Treyetech cartridge
   - Grafts were shipped via FedEx from Denver, CO to Baltimore, MD and back

4. **Staining and imaging**
   - Fluorescence staining was performed with a Calcein-AM stain for cell viability
   - Images analyzed by a masked grader using Fiji ImageJ with trainable segmentation

5. **Statistical Analysis**
   - A paired t-test was conducted between the scroll and tri-folded group

Results

- **Patient characteristics**: age range of donors was 44-74 years, death-to-preservation time range was 3:26-16:10 hours, death-to-preparation time range was 2-17 days
- **Cell loss**: prior to preloading and shipping, there was no significant difference in mean endothelial cell density between tissues that were scrolled or tri-folded (2626 vs 2575 cells/mm², p=0.82)
- **Cell loss after 96 hours**: no grafts in either group had been ejected from their cartridges
- The mean total ECL of all grafts was 14.2%
  - Total ECL in the scrolled group: 13.7% (95% CI, 10.9% to 16.4%)
  - Total ECL in the tri-folded group: 14.8% (95% CI, 11.1% to 18.5%)
- A paired t-test revealed no significant difference (p=0.68)

Conclusions

- DMEK grafts can be shipped for at least 96 hours with clinically acceptable levels of ECL
- A comparison between scrolled and tri-folded paired preloaded grafts in identical conditions revealed a non-significant difference in ECL
- The longer time interval allowed for shipping may build opportunities for clinical collaboration across large geographical distances

References


Disclosures

- Competing interests: CC, EC, KAB and AOE have ownership interest in Treyetech.