1934

LIONS VISIONGIFT

Manual adjustment of specular image analysis: Correcting what the computer can't see after DMEK

Zachary M. Mayko, MS[1,4], Beth Ann Benetz, MA[2,3], Christopher G. Stoeger, MBA, CEBT[1], Harry Menegay, PhD [2,3], Chris Donovan, BA[2,3], Mark A. Terry, MD[1,4], Jonathan H. Lass, MD[2,3]

1. Lions VisionGift, Portland, OR, United States. 2. Department of Ophthalmology and Visual Sciences, Case Western Reserve University, Cleveland, OH, United States 3. UH Eye Institute, Cleveland, OH, United States. 4. Legacy Devers Eye Institute, Portland, OR, United States.

Background

Many factors influence the derived value of endothelial cell density (ECD) in the clinic. An important factor to consider is the choice of method for counting cells using specular microscopy. At Devers Eye Institute, all specular images are evaluated using an automated method with manual correction (AMMC). This is uncommon however, as few places do image analysis similarly. In this study we wanted to validate our AMMC image analysis method against the accepted and widely used Center Method performed by a reading center by comparing determined ECDs and percent cell loss over time.

Purpose

To compare and validate a single clinical site's image analysis method for determining central ECD and endothelial cell loss (ECL) by an AMMC of specular microscopy images in postop DMEK patients compared to the Konan center method performed by a reading center.

Methods

A consecutive series of fifty nine patients who underwent DMEK surgery, and who had central donor graft as well as central 6 and 12 months post-surgery specular microscopic images available were retrospectively identified. Specular microscopic images of the central endothelium were first evaluated in the clinic using the AMMC by a technician. Images were then masked and provided to the Cornea Image Analysis Reading Center (CIARC) for analysis using the Center Method by certified readers using a dual grading and adjudication process.[1]

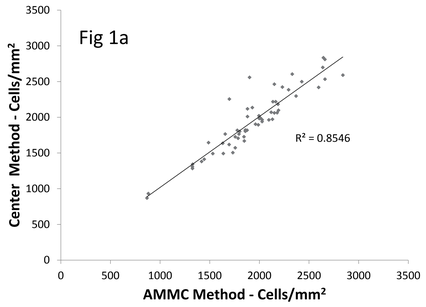
Disclosures - None

Results

	Center Method	AMMC	
6 Month ECD	1939 ± 407 cells/mm^2	1949 ± 437 cells/mm^2	p=0.67
12 Month ECD	1833 ± 470 cells/mm^2	1843 ± 435 cells/mm^2	p=0.63
Percent ECL Between 6 and 12 Months	6%	4%	p=0.36

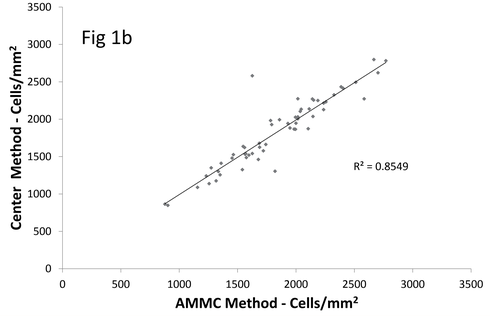
6 Month Endothelial Cell Densities

Fig 1a



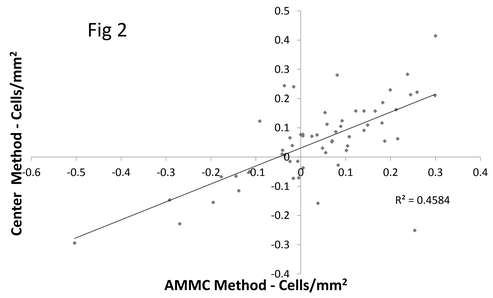
12 Months Endothelial Cell Densities

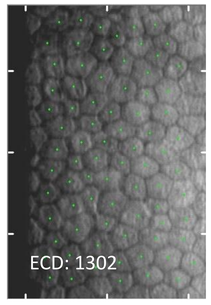
Fig 1b



Percent Cell Loss

Fig 2



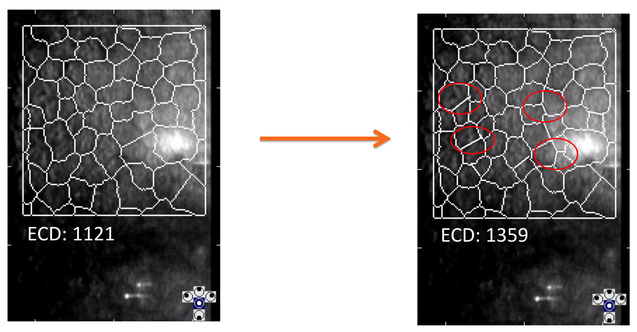


Center Method Example

To the left is an example of a specular image provided to the CIARC. To perform Konan Center Method Analysis, CIARC analysts manually marked the centers of contiguous cells.

Automated Method with Manual Corrections Example

To the right is an example of Konan's automated method for capturing ECDs. Once generated, technicians can go back and edit the overlay and cell borders to adjust the overall cell count. The frame size can be adjusted, cell borders added, or removed.



Discussion

For this project we evaluated how a single center's method of determining ECDs that takes advantage of both the computer's ability to rapidly identify cells as well as the corrective eye of the human observer compares to the commonly used Center Method.

- We found high levels of correlation between ECDs when comparing the single center's automated method with manual correction to the standard Center Method.
- Each method provided clinically equivalent degrees of percent endothelial cell loss between 6 and 12 months.

Clinical Significance

In the clinic, when time can be constrained, it can be a difficult choice to choose a method for *determining the ECD* in either a completely automated method or a completely manual method.

- Automated methods are quick but may have errors.
- Manual methods are very accurate but are time consuming (and in general are the gold standard)
- Automated method with the chance for manual correction can provide equivalent ECD values and percent cell loss to completely manual methods.

References

1. Price MO, Knight O, Benetz, BA, Debanne SM, Verdier D, Rosenwasser G, Rosenwasser M, Price FW, Jr., Lass JH: Randomized, prospective, single-masked clinical trial of endothelial keratoplasty performance with two donor cornea 4° storage solutions and associated chambers. Cornea 34:253-56, 2015. PMID 25625366

Contact: Zachary Mayko; zmayko@deverseye.org

Supported By Research to Prevent Blindness