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LIONS VISIONGIFT

Comparison of DMEK Scroll Tightness Between Donor Corneas Before and After Storage of Pre-Stripped Tissue in Optisol GS for 5 Days

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Layman Abstract

The ideal donor tissue for DMEK surgery has a good endothelial cell count, but is loosely scrolled to make the procedure easier. (Figure 1) Younger donors tend to have higher endothelial cell counts but tighter scrolls. Irrespective of the endothelial cell count, a tight scroll can be prohibitive because it is difficult to open intraoperatively. This is why many DMEK surgeons prefer donor corneas that are > 60-65 years of age. Unfortunately, this limits the donor-pool for DMEK surgery. If the tight scrolling associated with younger tissue could be modified by the eye bank, the donor-pool could be expanded significantly. What's more, the *ideal DMEK tissue could be realized: a donor with a good endothelial cell count and a loose scroll that can be easily opened.* **Our hypothesis is that aging DMEK tissue for several days after it is prepared for surgery could loosen the scroll and make it easier for the surgeon to open in surgery.**

Purpose

To ascertain whether storage of pre-stripped donor tissue for 5 days is associated with wider (i.e. looser) DMEK scrolls, which may be easier to open intraoperatively.

Methods

10 human corneas from 5 donors were pre-stripped and stored in Optisol GS. The tissue was then cut into a 7.5 mm graft with a Moria trephine, stained with trypan blue for 4 minutes, and measured from digital photos with Fiji by 2 observers who were masked from the tissue's storage time. **(Figure 4)** Five corneas were cut within 12 hours of pre-stripping and measured (Group A-12h), stored in Optisol GS as free-floating scrolls, and re-measured after 5 days (Group A-5d). The mates of Group A (i.e Group B) were stored as pre-stripped tissue, then punched and measured after 5 days (Group B-5d). Mean width was compared with a paired T-Test. Percentage change from the reference group (Group A-12h) were also compared between the grafts stored as free-floating scrolls and as pre-stripped tissue. **(Figure 2)**

Results

Median donor age was 54 years (Range 42-90). **Refer to Figure 3:** Scroll width decreased in Group A after storage for 5 days as a free-floating scroll (median: 1.14 vs. 1.06 mm; mean 1.21 vs. 1.10, P=0.01). **(Figure 2*i*)** Scroll width also decreased in Group B (i.e. the mates of Group A) after storage for 5 days as pre-stripped tissue (median: 1.14 vs. 1.05 mm; mean 1.21 vs. 1.12 mm, P=0.02). **(Figure 2*ii*)** There was no difference in the percentage decrease in scroll width between Group A, stored entirely as a free- floating scroll, and Group B, stored initially as pre-stripped tissue, at 17 days (7.2% vs. 8.8%, P=0.22). **(Figure 2*iii*)**

Figure 1. Scrolls of Varying Tightness

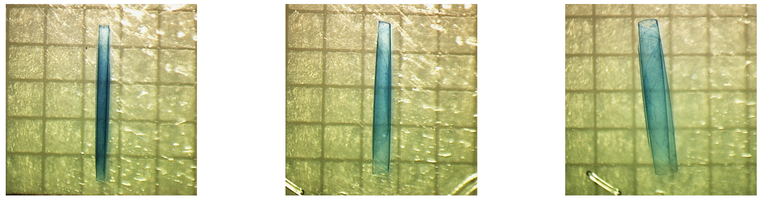


Figure 2. Schematic of the Study Design

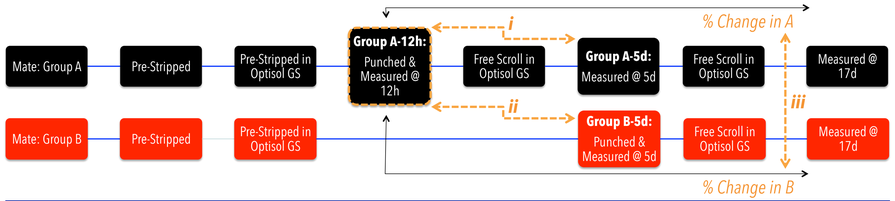


Figure 3. Mean Scroll Width Comparison Between Donor Tissue Mates

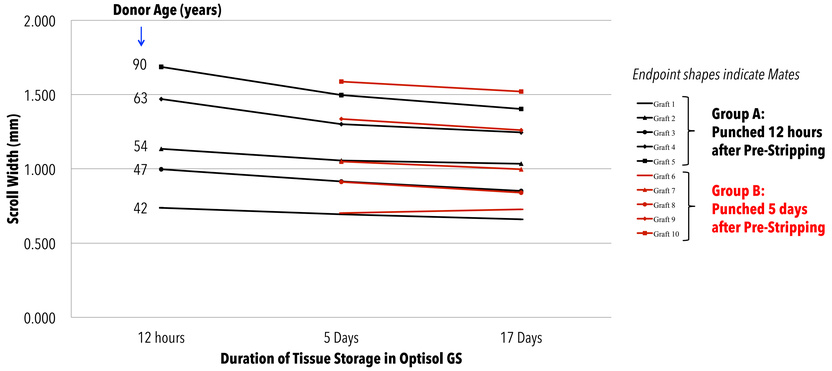
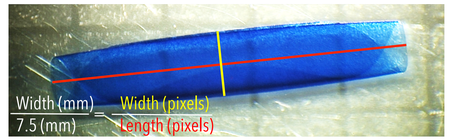


Figure 4. Method for Measuring Scroll Tightness



Conclusions

***Contrary to our hypothesis,* storing DMEK tissue after it has been pre-stripped tightens its scroll width**, which may make it more difficult to open intraoperatively. Five days in Optisol GS has the same effect on scroll width, whether the graft is stored as a free-floating scroll or as pre-stripped tissue, which is not surprising. Price has postulated that DMEK grafts scroll because of endothelial cell swelling,[1] Melles has hypothesized that it is because of the tissue's elastic properties,[2] and Moshirfar has confirmed the presence of elastin in the membrane.[3] Longer storage times might make the endothelium more edematous and thus tighten the scroll. Alternatively, the effect of Optisol GS on the collagens and elastin in the banded and non-banded zones of Descemet membrane might be playing a greater role in DMEK scroll tightness than the endothelium. Further studies are needed to investigate these postulates.

References

1. Personal communication with Price F, as cited by Moshirfar M (#3).
2. Lie JT, et al (Melles G). Donor tissue preparation for Descemet membrane endothelial keratoplasty. JCRS 2008;34:1578-83.
3. Moshirfar M, et al. Descemet membrane endothelial keratoplasty: why does the donor tissue roll? Cornea. 2013;32:e52-3.

Financial Interest Disclosure

CSS – None ; ZMM – None; CS – None; MAT – None; MDS – None.

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