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Capstone 2024 Abstract

Title: Human Breast Milk Enhances Cellular Proliferation in Cornea Wound Healing

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Purpose: Corneal epithelial defects from ulcers, trauma, or surgery heal as new epithelial cells grow centripetally from the limbus and replenish the epithelium. Corneal wound healing requires cell signaling molecules. However, a topical treatment with these components is not available. Human breast milk (HBM) offers a potential, novel treatment as it contains bioactive molecules important in epithelial cell healing. This study seeks to investigate the potential of HBM in cornea wound healing.

Methods: Balb/C mice, 8-12 wks old, were anesthetized prior to creating a 2mm central cornea epithelial defect. Mice were randomly assigned to a treatment group: HBM, ophthalmic ointment containing neomycin, polymyxin B, dexamethasone (RxTx), or saline and treated 4x/day for 2 days. Wound area was quantified by fluorescein and ImageJ at 0, 8, 24, and 48h post wounding and eyes used for histology, RT-qPCR, and ELISA.

Results: Wounded corneas treated with HBM demonstrated increased re-epithelialization at 8h post injury compared to RxTx and saline treatments. ELISA showed significantly higher Ki67 in HBM treated eyes vs. saline control at 8h ($p=0.0278$). Additionally, immunohistology revealed more Ki67 positive cells in the HBM group compared to saline at 8h and 24h ($p=0.0063$ 8h; $p=0.00072$ 4h). For inflammatory analysis, HBM group IL-1 β levels were similar to the saline group, and higher than RxTx treated eyes ($p<0.05$). Immunohistochemical staining for CD11b (macrophage marker) revealed HBM-treated eyes had significantly more positive cells vs. saline. RT-qPCR of limbal stem cell markers (LESCs) revealed upregulation of Integrin αV at 8h with HBM vs. saline.

Conclusions: HBM treatment on corneas with debridement of epithelium demonstrated improved healing, cellular proliferation, and upregulation of the LESC gene transcript, integrin αV , after wounding. Future studies could investigate LESC response to different signaling molecules in HBM to better understand the efficacy of this potential therapy.