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Corneal Dry Eye | Application Note

Modeling Dry Eye Disease (DED) and Ocular Surface Damage Using EpiCorneal

Objective

To investigate the pathogenesis of ocular surface damage and dry eye disease (DED) using the EpiCorneal *in vitro* human 3D tissue model.

Methods

Oxidative stress was generated by exposing the EpiCorneal tissues to non-toxic doses of UVB, hydrogen peroxide, or by placing tissues under desiccating stress conditions (DSC) for up to 72 hours in the presence and absence of topical lubricating eye drops. At the end of each treatment, the culture medium was collected and analyzed for release of 8-Isoprostane and cytokines. Also, tissues were fixed and stained with H&E or harvested for gene analysis or tissue viability (MTT assay).

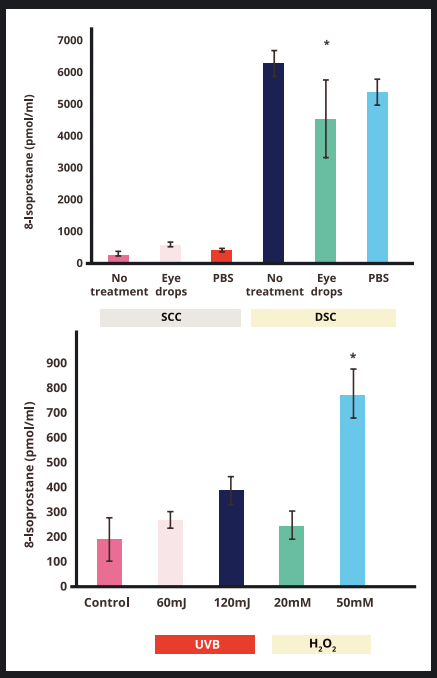

Figure 2. EpiCorneal tissues were exposed to UVB, dosed topically with H_2O_2, or exposed to DSC (40 °C/60%RH) for 24 hours in the presence and absence of topical lubricating eye drops, GenTeal (Alcon), Contrived Tears (Ursa BioScience) or PBS.

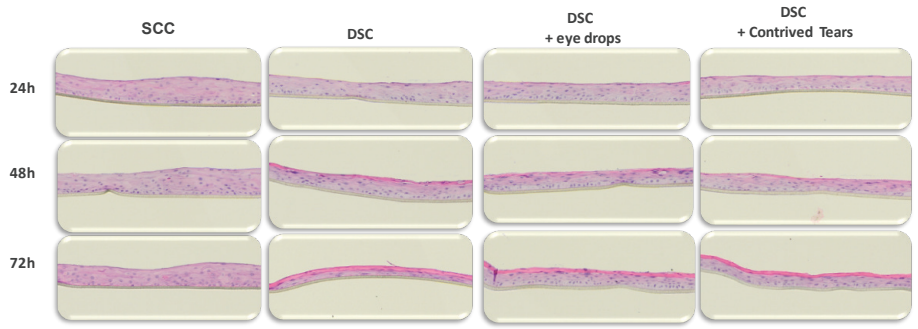

Figure 1. Histological cross-sections of EpiCorneal tissues, H&E stained. Note appearance of stratum corneum at 48 hours and significant tissue dehydration at 72 hours under DSC (40˚C, 60%RH, 5%CO_2).

Results

Dramatic reduction in tissue thickness was observed for EpiCorneal tissues incubated at DSC (40˚C, 60% RH, 5%CO_2). Tissue viability was not significantly impacted. Topical application of lubricant eye drops improved tissue morphology and barrier function. Oxidative stress (exposure to UVB or H_2O_2) and incubation under DSC induced the release of 8-Isoprostane and IL-8 and upregulated the expression of genes for the pro-inflammatory cytokines, IL-1α and IL-1β.

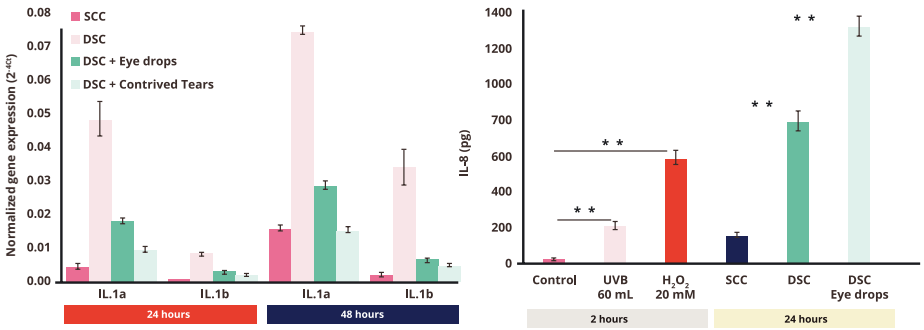

Figure 3. EpiCorneal tissues were treated as in Figure 2 in the presence and absence of topical lubricating eye drops, GenTeal or Contrived tears. The housekeeping gene, GAPDH, was used for normalization. *p≤0.05; **p≤0.001.

Conclusion

The EpiCorneal tissue structurally and functionally reproduces corneal oxidative stress and DED markers providing a comprehensive *in vitro* tool to study DED and develop ophthalmic pharmaceuticals.