Restasis® Modulates Sulfur Mustard Induced Meibomian Gland Rabbit Eyelid Injury

Jieun Kang, Gabriella Wahler, Laurie B. Joseph
Rutgers, The State University of New Jersey

Sulfur mustard (SM) is a bifunctional alkylating agent used in chemical warfare. As a chemical vesicant, sulfur mustard induces damage to the skin, respiratory tract, and eyes. SM can cause ocular irritation, pain, photosensitivity, short-term blindness, and dry eye. Dry eye is due in part to abnormal eyelid function, including changes in the meibomian gland, a type of sebaceous gland that secretes meibum to maintain the tear film. We hypothesize that SM will induce expression of keratin-1, a marker of epithelial differentiation, in meibomian glands, and Restasis® will decrease the SM induced keratinization. Restasis® is a 0.05% cyclosporine ophthalmic emulsion used to treat Meibomian Gland Dysfunction (MGD) or Dry Eye Syndrome. New Zealand white male rabbits were exposed to SM (0.4 µL, neat) in the right cornea and air (control) in the left (MRI Global, Kansas). Two hours post SM exposure, rabbits were treated with Restasis® twice daily. Animals were sacrificed at 28 days, eyelids were removed, fixed in paraformaldehyde, embedded in paraffin, sectioned, and stained for keratin-1 and examined histologically using hematoxylin and eosin. Keratin-1 expression was upregulated in the meibomian glands of SM treated rabbits compared to the control, while Restasis® decreased SM induced keratinization of the meibomian glands. These results suggest that SM injury to the cornea has a secondary effect on eyelids through increased epithelial differentiation in the meibomian glands as seen in MGD. Taken together, these data indicate that Restasis® may be a treatment for SM induced ocular damage. Future experiments will determine if Restasis® mitigates SM induced damage to the eyelids by investigating the expression of proliferating cell nuclear antigen, a marker of cell division/wound repair and COX-2, a marker of inflammation. Supported by NIH U54AR055073, P30ES005022, T32ES007148 (GW), R25ES020721 and the Summer Undergraduate Research Fellowship (SURF) (JK).