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The effects of corneal cooling on tear production, blink rate and sensation
Recipient of 2009 Student Fellowship Award

Lay Abstract:

Dry eye may be caused in part by inadequate tearing and blinking when the corneal surface becomes dry. The proposed research will determine how sensory cells of the cornea in normal adult humans cause non-painful reflex tearing, blinking as well as subjective sensation. Our working hypothesis is that unique corneal sensory cells that respond to modest cooling of the cornea are critical for eliciting tears and blinking without producing pain. The effect of cooling the eye on tears, blinking and sensation will be assessed in human volunteers. It is hypothesized that cooling the eye will induce tears and/or blinking. Understanding how modulation of corneal sensory neurons affects reflex tearing and blinking can lead to treatments for dry eye that will enhance tearing by increasing the activity of the appropriate sensory neurons.

Scientific Abstract:

The causes of dry eye may include an inability of neurons to properly regulate the release of tears. We have recently discovered a unique class of corneal sensory neurons that are activated by drying and cooling the corneal surface, properties consistent with a role in the modulation of basal tearing. The proposed studies test the hypothesis that selective activation of these neurons will produce an increase in tearing or blinking without producing corneal pain. The aim of this study is to examine the effect of cooling the ocular surface on tear production, blink rate, and subjective sensations in human volunteers. Dysfunction of dry/cool responsive corneal neurons may be responsible for some forms of dry eye disease, while the ability to increase the sensitivity and activity of these neurons to drying of the ocular surface represents a potential strategy for the treatment of dry eye.