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Ocular Surface Cooling as a Potential Stimulus for Blinking

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Abstract

Purpose: Animal models have identified the activation of corneal cold receptors as the noxious stimulus primarily responsible for tearing and could also be the potential stimulus for blinking. Previous studies have found that a faster tear breakup time is associated with an increased blink rate but there has been a lack of direct examination on how cooling of the ocular surface is linked to the blink process. In this study, we aim to determine if the ocular surface cooling (OSC) rate is associated with how long an individual can refrain from blinking.

Methods: Subjects were acclimated to the exam room for 10 minutes before measurements. They were asked to open their eyes and refrain from blinking for as long as they could, even if they experienced discomfort, while the ocular surface temperature (OST) was measured. Each measurement period was termed the maximum inter-blink period (MIBP). A total of ten measurements were taken with four successive blinks separating each period. OST was measured using an infrared thermographer (FLIR A655sc) and the OSC rate was analyzed using commercially available software.

Results: 17 subjects (11 females, 6 males) completed the study. The mean OSC rate in the study was .047^{0}C/seconds (range: 0.0002-0.3477^{0}C/seconds) with a mean MIBP of 17.2 seconds (range: 1.1-90.5 seconds). Using a linear mixed effects model with a natural log-transformed MIBP, increased OSC rate was significantly related to a shorter MIBP ($p<0.001$). Based on the statistical model, it is estimated that an individual would be able to refrain from blinking for an additional 16.0 seconds if they had the minimum OSC rate found in the study (0.0002^{0}C/seconds) when compared to someone with the maximum OSC rate (0.3477^{0}C/seconds).

Conclusions: Our results show that the OSC rate was related to how long an individual could refrain from blinking, suggesting that OSC may be a potential stimulus for a blink.

The Association for Research in Vision and Ophthalmology