

Title:

Effects of a warm compress with menthol on the tear film conditions

Purpose:

It is known that menthol binds to Transient receptor potential cation channel subfamily M member 8, stimulating lacrimation via activation of corneal cool primary afferent neurons. To investigate the effects of a warm compress using a disposable eyelid-warming steamer with menthol on the tear meniscus and the tear film stability.

Methods:

Eighteen eyes of 18 healthy volunteers (mean age \pm SD, 34.6 ± 6.6 years; range, 22-44, 9 males and 9 females) without dry eye symptoms evaluated by the Dry Eye-related Quality-of-life Score (DEQS < 10) were enrolled. Two types of disposable eyelid-warming steamers that were menthol-containing type (M+) and menthol-free type (M-) were applied to subjects with single warming (once for 10 minutes). Repeated M+ warming (10minutes, twice a day for 2 weeks) was performed for the evaluation of continuous warming effect. We evaluated tear break up time (BUT), strip meniscometry (SM) value which was reflected tear meniscus volume, surface temperature of the central cornea/ upper tarsal conjunctiva/ lower tarsal conjunctiva by thermography, meibum-score and meibo-score by non-contact meibography. Evaluation of repeated warming was performed after at least 8 hours from latest warming.

Results:

Single warming with both M+ and M- steamers increased the surface temperature of central cornea, upper and lower tarsal conjunctiva. Single warming with M+ significantly increased SM value (from 4.5 ± 1.7 to 7.1 ± 2.1 mm, $p < 0.001$) and BUT (from 4.2 ± 1.6 to 6.2 ± 2.5 s, $p < 0.05$). Single warming with M- did not affect SM value nor BUT. Repeated warming with M+ significantly increased SM value (from 4.5 ± 1.7 to 6.8 ± 3.2 mm, $p < 0.01$) and BUT (from 4.2 ± 1.6 to 6.2 ± 3.3 s, $p < 0.05$). Repeated warming did not change meibum score, meibo-score nor surface temperature of the ocular surface.

Conclusion:

Single warming by the steamer with menthol increased tear meniscus volume and tear film stability. Repeated warming by the steamer with menthol maintained the increased tear meniscus volume and tear film stability. These findings suggested that the warm compress with menthol might have potential to contribute to dry eye disease.