Eye drops for preventing dry eye in adverse environments

Dry eye disease is a common chronic condition, affecting between 5% and 50% of the adult population in different parts of the world. Adverse environmental conditions, including low relative humidity and high airflow velocity, are recognised to exacerbate symptoms and signs of dry eye disease. Such conditions are widespread in the modern urban environment, for example air-conditioned and central-heated workplaces or windy streets, and can augment the water vapour pressure gradient between the ocular surface and surrounding environment, thereby facilitating increased tear evaporation and reducing tear film stability.

Fig. 1. he lipid containing artificial tear eye drop (Systane® Balance), and non-lipid containing artificial tear eye drop (Systane® Ultra).

Artificial tear eye drops are among the most commonly used dry eye treatments, with both lipid and non-lipid containing formulations commercially available. Non-lipid containing eye drops supplement the aqueous component of the tear film, with the aim of providing additional lubrication to the ocular surface and decreasing the risk of desiccation. Lipid containing eye drops are designed to fortify the surface lipid layer of the tear film, which acts to inhibit and retard aqueous tear evaporation. The aim of the current study was to evaluate the protective potential of lipid and non-lipid containing eye drops applied prior to the exposure of the tear film to adverse environmental conditions.

Thirty participants with symptomatic dry eye were recruited into a prospective, double-masked,

randomised paired-eye trial. Each participant was randomised to simultaneous application of a lipid containing eye drop (Systane® Balance) to one eye, and application of a non-lipid containing eye drop (Systane® Ultra) to the other eye (Fig. 1). Participants were then exposed to a validated simulated adverse environment model, ten minutes after eye drop application. Clinical measurements, including non-invasive tear film stability, tear film lipid layer grade, tear meniscus height, ocular surface temperature variation factor, low contrast glare visual acuity, and subjective ocular comfort were conducted at three time points; baseline, ten minutes following eye drop application, and immediately after exposure to the simulated adverse environment.

The results of the study showed that both the lipid and non-lipid containing drop effected a significant improvement in tear film stability 10 minutes following topical application, and prevented its decline below baseline following exposure to the simulated adverse environment (Fig. 2). However, post-instillation improvements in tear film lipid layer quality and the prevention of its decline below baseline levels were limited to the lipid containing eye drop. Furthermore, the lipid containing eye drop also demonstrated superior post-instillation and post-exposure tear film stability, lipid layer quality, and subjective ocular comfort than the non-lipid containing eye drop. No significant adverse events were reported following the instillation of either artificial tear eye drop, and no changes in vision, tear meniscus height, or ocular surface temperature variation factor were detected with either treatment.

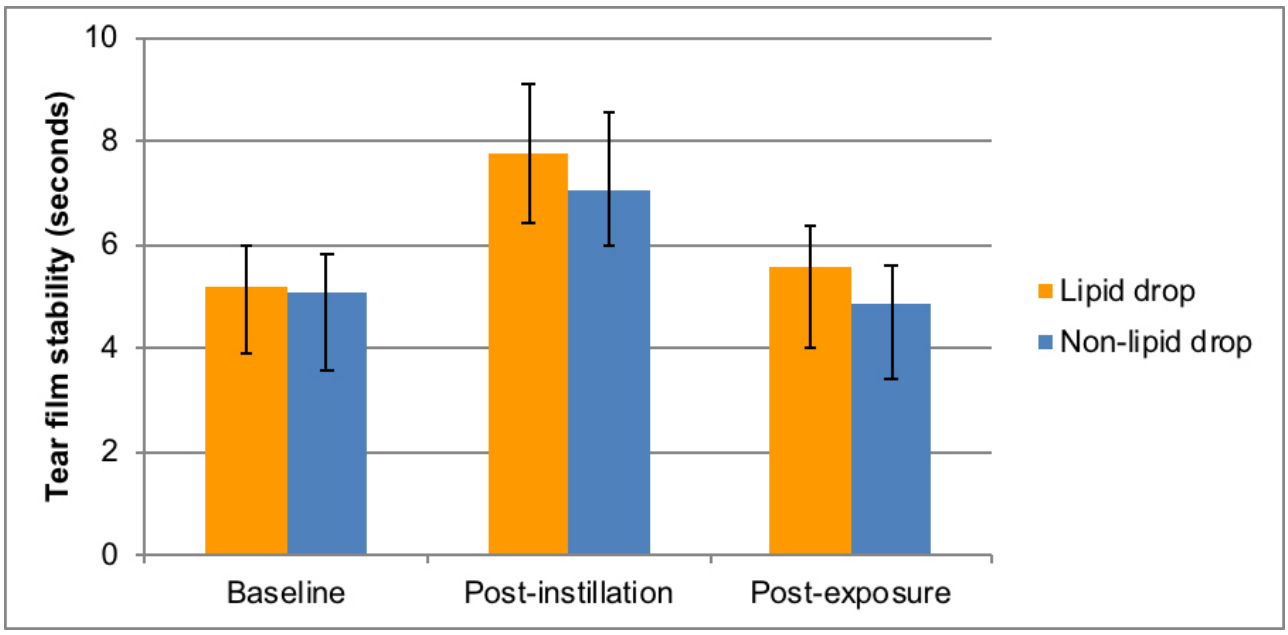

Fig. 2. Non-invasive tear film stability of the eyes of participants randomised to lipid and non-lipid containing eye drops at baseline, ten minutes following eye drop application, and immediately following exposure to the simulated adverse environment. Bars represent the median tear film stability, and error bars represent the interquartile range.

Overall, the findings of the study showed that instillation of both the lipid and non-lipid containing eye drops conferred protective effects against exposure to adverse environmental conditions in patients symptomatic of dry eye. However, the lipid containing eye drop demonstrated superior protective effects in maintaining tear film stability and lipid layer quality than the non-lipid containing eye drop, and was the preferred topical formulation among patients exhibiting symptomatic dry eye.

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