

Comparison of tear film stability before and after a single 5-minute exposure to a heated warm compress



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Abstract

This investigation sought to determine whether moist heat compress therapy induces a change in tear film stability. The study included 54 eyes of 27 patients that underwent 5-minute bilateral application of a heated mask (Bruder Mask, Bruder Healthcare) and pre and post color LED topographer imaging (Surface Qualifier, Cassini). MMP-9 and tear osmolality were also tested. Comparison of Surface Qualifier images before and after heated moisture mask exposure revealed that after short term exposure to the heated moisture mask, a significantly greater percentage of patients (56%) had a more stable tear film after undergoing the heated mask exposure treatment as compared to the percentage of patients with stable tear film before treatment (28%). Odds ratio was 2.895, suggesting that patients were almost 3 times more likely to have a more stable tear film after the heated mask application. In conclusion, brief exposure to moist heat eye compress therapy has a significant effect on tear film stability, regardless of health, preexisting ocular conditions, or contact lens wear. In all patient groups studied, moist heat therapy improved ocular surface characteristics by at least 200%.

Introduction

Meibomian gland health is essential to a stable tear film and to the overall health of the ocular surface. The tear film is composed of lipids, proteins, mucins, electrolytes and other substances,¹ that must balance in such a way as to promote health and homeostasis. Meibomian gland contents contribute to this delicate process. The lipid layer is the most superficial tear film layer and is created by the meibomian glands.² With each blink, meibum is secreted from the gland orifices and is spread onto the tear film. The resulting tear film lipid layer stabilizes the overall tear film and is thought to play a key role in retarding tear evaporation.¹

Ocular surface health is important for all patients and is especially important in cataract and refractive surgery candidates—not only to prevent post-operative dry eye, but also to optimize visual outcomes, which are highly dependent on pre-operative measurements. For instance, in cataract surgery patients, an unstable tear film reduces the quality of corneal reflections and therefore can compromise K readings, which in turn can affect the accuracy of IOL calculations and result in suboptimum refractive results.^{3,4}

There is a large and growing list of treatments for dry eye generally and MGD specifically, including the application of heat to the eyelids. In fact, warm compresses have long been considered a mainstay treatment for MGD, with several studies showing greater tear film stability and increased tear film lipid layer thickness in patients with MGD following treatment.⁵⁻⁸ The application of heat to the meibomian glands is thought to soften meibum, improve secretion, and increase tear lipid layer thickness. However, applying heat to the eyelids poses several challenges. To achieve therapeutic effectiveness, heat must reach 40°C without causing thermal injury to the ocular surface.⁹ Several methods exist including using a warm wet washcloth or a heated rice bag, as well as commercially available alternatives, which studies have shown have varying levels of effectiveness.¹⁰ The Bruder Moist Heat Compress was chosen for this investigation because it has been shown capable of warming the eyelids to the therapeutic temperature required and is capable of maintaining a high level of heat for twice as long as the 5-minute use intended in this study.^{9,10}

Methodology

This clinical pilot study was conducted at a single-center, multispecialty ophthalmology practice. All assessments and patient queries were conducted at the clinical site by certified investigators and technicians. The patient profiles include data from 27 patients treated with Bruder Moist Heat Eye Compress (Bruder Healthcare, Alpharetta, Georgia, USA) with results interpretation provided by SKIE (Springfield, IL, USA).

Because the purpose of this investigation was to determine the effect of therapy on any patient—regardless of health, pre-existing ocular conditions, or contact lens wear at initial presentation—subjects were chosen consecutively with no inclusion criteria other than agreement to participate in the investigation by submitting to the diagnostic tests and 5-minute mask treatment. Exclusion criteria for the study centered on the ability to obtain ocular surface analysis test results. Patients were excluded from the study population based on a lack of complete test results (test results were not available or patients refused to have the test performed). No other exclusion criteria associated with past or present medical history were utilized.

Demographic information (age and sex), as well as history of diabetes and contact lens wear were documented. In addition, MMP-9 and tear osmolality were tested at baseline. In addition to baseline diagnostics, Surface Qualifier image analyses were performed on all patients before and after treatment with moist heat therapy. The Surface Qualifier image displays the tear film with blocks and lines in seven quadrants. Regular yellow blocks and lines in all seven quadrants suggests a stable tear film, whereas irregular blocks and wavy lines indicate an unstable tear film. (See figure 1).

In order to maximize objectivity, a blind observer model was used in this study. A random number generator was used to remove all identifying patient data to each Surface Qualifier image. The observer did not know which eye was being observed, thus data observation was random and unbiased. Observations were assigned 0 for healthy, and 1 for unhealthy, ultimately creating a binary outcome variable for analysis. A stable tear film (0) consisted of fully formed and regular yellow blocks and lines in all seven quadrants of the recorded image. An unstable tear film was recorded as 1 if missing/irregular blocks and wavy lines were present. Observations were then entered into a spreadsheet, which matched the blind observations with identifying data and demographics information for each eye. Data analysis included paired t-tests and chi square tests. Statistical analysis was conducted to compare Surface Qualifier images before and after exposure to the Bruder Mask and to test for possible confounding variables.

Descriptive statistics were prepared for the patient demographic information of age (mean, median, minimum, and maximum), sex (%), and ethnicity (%). Patient subgroups were determined based on contact lens wear and tear film stability prior to treatment.

Figure 1

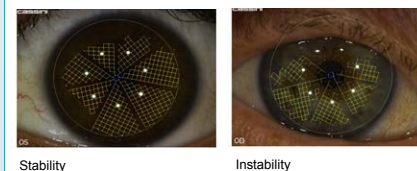
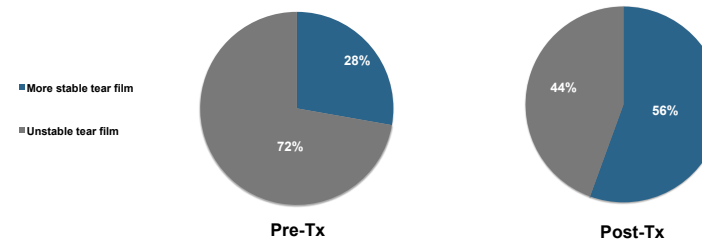


Figure 2

Tear Film Stability Improved Following Treatment



Based on all eyes studied, patients were 3 times more likely to have a more stable tear film following short-term exposure to the Moist Heat Compress

Results

Thirty-three consecutive patients (66 eyes) were enrolled in the study. Six patients (12 eyes) were excluded from the study due to the inability to collect ocular surface analysis images following treatment. A total of 27 patients (54 eyes) met the inclusion criteria and were evaluated in this analysis.

The mean age of all patients was 54.70. Twenty-four participants (48 eyes) were female and 3 were male (6 eyes). Three patients had a history of diabetes (6 eyes) and 7 (14 eyes) were contact lens wearers. Ten eyes (18.5%) tested positive on Inflammadry MMP-9 and 37 eyes (68.5%) had abnormal tear osmolality at initial presentation.

Seventy two percent (39 eyes) of the total test sample presented with unstable tear film and 28% (15 eyes) had a stable tear film prior to the heated compress treatment. Following a 5-minute treatment with the Bruder Moist Heat Eye Compress, 44% (24 eyes) remained unstable, whereas stable tear film eyes increased to 56% (30 eyes). Based on all eyes studied, patients were 3 times more likely to have a stable tear film following short-term exposure to the Bruder Mask (OR = 2.895).

Prior to treatment, thirty-nine eyes had unstable tear film, but nearly half of these eyes (49%) converted to stable tear film following a 5-minute treatment with the moist heat compress. In other words, patients with unstable tear film were two times less likely to have an unstable tear film following short-term exposure to the Bruder Mask. In the healthy eye group, only 15 eyes had stable tear film prior to treatment with the moist heat compress. This number jumped to 30 eyes following treatment, representing a 100% increase in healthy eyes.

Fourteen patients in the study were contact lens wearers. In the eyes of these patients, 79% (11 eyes) presented with unstable tear film prior to treatment. However, following a 5-minute treatment with the moist heat compress, stable tear film eyes jumped from 21% (3 eyes) to 50% (7 eyes). In other words, contact lens wearers were 3.67 times more likely to have a stable tear film following short-term exposure to the Bruder Mask.

Conclusion

Warm compress therapy is generally considered to be good supplemental therapy for MGD and is therefore routinely recommended. The current investigation further confirmed even a brief exposure to moist heat eye compress therapy has a significant effect on tear film stability, regardless of health, pre-existing conditions, or contact lens wear. In all patient groups studied, Bruder Moist Heat Eye Compress therapy improved ocular surface characteristics by at least 200%, indicating that this treatment is considerably effective even when universally applied across diverse patient populations.

There are some limitations to the current investigation. In particular, the short timeframe between treatment and follow-up testing restricts our ability to ascertain duration of treatment effect. In addition, this study evaluates only a single moist heat treatment, which makes it impossible to determine whether greater benefits might be observed following long-term therapy.

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