Contact Lens Update
CLINICAL INSIGHTS BASED IN CURRENT RESEARCH

Article Review: Eyelid Warming Devices: Safety, Efficacy, and Place in Therapy

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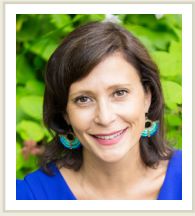

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Bzovey, Brandon, and William Ngo. "Eyelid Warming Devices: Safety, Efficacy, and Place in Therapy." Clinical Optometry (2022): 133-147.

In the past, treatment for meibomian gland disfunction (MGD) has consisted of at home care with the aim of loosening thickened meibum to subsequently improve patient symptoms and tear film homeostasis. The introduction of in-office treatments to improve glandular secretions began in 2011 with the introduction of LipiFlow Thermal Pulsation (Johnson & Johnson, FL, USA) after years of research by Donald Korb and colleagues.[1, 2, 3]

Recently, Bzovey and Ngo have complied a review of 58 clinical studies examining the safety and efficacy of eyelid warming devices. This is an excellent resource that can guide eye care practitioners (ECPs) in better developing treatment plans for patients with MGD. Furthermore, the article provides an excellent overview into what office-based treatments can do to improve patient outcomes in this population.

Introduction to MGD

The article begins with a brief review of MGD:

In 2017, the Tear Film and Ocular Surface Dry Eye Workshop II (TFOS DEWS II) redefined dry eye disease (DED) as:

> …a multifactorial disease of the ocular surface characterized by a loss of homeostasis of the tear film, and accompanied by ocular symptoms, in which tear film instability and hyperosmolarity, ocular surface inflammation and damage, and neurosensory abnormalities play etiological roles.[4]

This loss of homeostasis is often seen in patients with MGD in the form of rapid tear break up times. MGD is considered to be the most common cause of evaporative dry eye disease and is defined by The International Workshop on Meibomian Gland Dysfunction as:

> … a chronic, diffuse abnormality of the meibomian glands, commonly characterized by terminal duct obstruction and/or qualitative/quantitative changes in the glandular secretion. It may result in alteration of the tear film, symptoms of eye irritation, clinically apparent inflammation, and ocular surface disease.[5]

In the clinic, evaluation of MGD includes assessing symptoms, examining meibomian gland morphology using meibography or transillumination, determining the expressibility of the glands, and evaluating tear film stability. For patients, MGD often disrupts daily activities with ocular symptoms of burning, stinging, itching, irritation, light sensitivity, and fluctuating vision.

Interestingly, this review succinctly points out that the temperature required to soften or liquify pathological meibum is greater than 40°C, significantly higher than that for normal meibum, which is approximately 34°C. Warm towels or washcloths are a common recommendation to achieve this however, the authors highlight work showing that they rapidly lose heat and take longer than the recommended five-minute application time to heat the inner eyelid to a therapeutic level. Based on this evidence, ECPs must educate their MGD patients and transition away from warm wash cloths, while moving towards the use of more efficient methods, including in-office treatments.

Review of the Literature

The authors of this review conducted a search of PubMed using a variety of predefined terms including “MGD”, “dry eye”, and the associated treatment modalities. This yielded 58 eligible studies where data of clinical outcomes from treatment with eyelid warming devices could be extracted. As some of the studies examined multiple treatment modalities, they were duplicated to yield a total of 62 studies. The data was then organised into three categories in order to provide an informative overview on clinical efficacy:

1. Improved symptoms (S): where participants demonstrated a statistically significant improvement in any symptom assessment metric, e.g., Ocular Surface Disease Index, Standard Patient Evaluation of Eye Dry, visual analogue scores, or other surveys.
2. Improved tear stability (T): where participants demonstrated a statistically significant improvement in non-invasive or invasive tear breakup time.
3. Improved meibomian gland function (M): where participants demonstrated a statistically significant improvement in meibomian gland obstruction, meibum quality, expressibility, meibography, and lid margin features.

The treatments were also stratified into the following modalities: heated eye coverings, moisture chamber, devices that deliver a combination of heat and pressure, intense pulsed light (IPL), and others (low level light therapy (LLLT) and Quantum Molecular Resonance). Table 1 provides a summary of all the studies that were included in this review.

Table 1 Number of Studies per Treatment Modality

Treatment	Number of Studies	Clinical Improvement
Heated eye coverings	9	S: 7/9 (78%)
		T: 5/9 (56%)
		M: 4/9 (44%)
Moisture chamber	13	S: 8/13 (62%)
		T: 6/13 (46%)
		M: 1/13 (8%)
Devices that deliver a combination of heat and pressure	20	S: 19/20 (95%)
		T: 17/20 (85%)
		M: 19/20 (95%)
Intense pulsed light	23	S: 22/23 (96%)
		T: 20/23 (87%)
		M: 20/23 (87%)
Low level light therapy	1	S: 0/1 (0%)
		T: 0/1 (0%)
		M: 1/1 (100%)
Quantum molecular resonance	1	S: 1/1 (100%)
		T: 1/1 (100%)
		M: 1/1 (100%)
Total	62	S: 52/62 (84%)
		T: 44/62 (71%)
		M: 41/62 (66%)

Abbreviations: S, improved symptoms; T, improved tear stability; M, improved meibomian gland function.

Lessons Learned

Heated Eye Coverings:

Heated eye coverings are typically employed as the first line of treatment for mild MGD. They are affordable and easy to use, with minimal risk to patients. They typically consist of microwavable beads that retain heat or controlled chemical reactions that generate heat. Of the nine studies reviewed in this paper, 78% (7/9) reported improvement in symptoms, 56% (5/9) reported improvement in tear stability, and 44% (4/9) reported improvement in meibomian gland function. Despite the above, studies show that only 55% of patients are compliant with warm compresses and lid hygiene after six weeks of use.

Place in Therapy:
TFOS DEWS II Management Strategy: Stage 1
Stage of MGD: Mild
Adverse Events: Mild discomfort noted in 2/9 studies reviewed

Moisture Chambers:

These devices provide heat and moisture simultaneously. A total of 13 studies were included in this analysis.

The review found improved symptoms in 62% (8/13), improved tear stability in 46% (6/13), and improved meibomian gland function in 8% (1/13) of studies. The most commonly researched product in this category was the Blephasteam (Théa Pharmaceuticals Limited, Keele, UK). Bzovey and Ngo state that an advantage moisture chamber goggles may have over heated eye coverings is the ability to maintain consistent temperature control and simultaneously supply moisture.

Place in Therapy:
TFOS DEWS II Management Strategy: Stage 2
Stage of MGD: Moderate
Adverse Events: None reported

Devices That Deliver a Combination of Heat and Pressure:

In 2011, in-office treatment for MGD was introduced with the advent of LipiFlow Thermal Pulsation (Johnson & Johnson, FL, USA). Soon after, the iLux (Alcon, TX, USA) and TearCare (Sight Sciences, CA, USA) devices were introduced as options for heat and gland expression in the office. While the LipiFlow instrument was first in demonstrating sustained treatment efficacy for signs and symptoms of MGD, the iLux and the TearCare have each demonstrated non-inferiority to it. This gives ECPs options, as the cost to acquire the devices can vary significantly.

Collectively, a total of 20 studies examined these heat and pressure devices for treating MGD. Improvements were seen in symptoms in 95% (19/20), tear stability in 85% (17/20), and meibomian gland function in 95% (19/20) of the studies. While there was a greater representation for the LipiFlow system in this review, one can reasonably assume similar effects may be seen with the newer iLux and TearCare devices.

The review clearly shows the value of these in-office treatments for moderate to severe MGD, with overwhelmingly positive data for all categories of efficacy. These treatments should be presented as an option to all eligible patients whether the diagnosing ECP has the treatment available within their clinic or knows where to refer. Failure to recommend these treatments can have a negative impact on patient outcomes and progression of this chronic disease.

Place in Therapy:
TFOS DEWS II Management Strategy: Stage 2
Stage of MGD: Moderate to Severe
Adverse Events: Discomfort reported in 5/20 of the studies

Intense Pulsed Light:

The delivery of non-coherent light (500 nm – 1200 nm) is thought to treat MGD through the direct delivery of heat to the meibomian glands, the photocoagulation of telangiectatic vessels along the lid margin, by aiding in the reduction of inflammation, and through a photomodulatory effect that alters intracellular metabolic activity of the meibomian glands.

This review found 23 studies examining the efficacy of IPL in treating MGD. The most common devices encountered in these studies were the Lumenis M22 (Yokneam, Israel) and the E-Swin E>Eye (Houdan, France). IPL improved symptoms in 96% (22/23), tear stability in 87% (20/23), and meibomian gland function in 87% (20/23) of studies, again demonstrating superiority over heated masks and moisture chamber goggles.

TFOS DEWS II Management Strategy: Stage 2
Stage of MGD: Moderate to Severe
Adverse Events: Reported in 2/23 of studies.

LLLT and Quantum Molecular Resonance:

LLLT is a technique which applies red or near infra-red radiation using low power light sources to promote tissue repair, decrease inflammation, and relieve pain. Quantum molecular resonance applies high frequency, low intensity electrical currents to create magnetic fields that alter biological tissue function, which has been found to have anti-inflammatory and tissue regeneration properties. Currently, there is only one study available for both of these new treatments (Table 1) and more research is required to determine their safety and efficacy.

Conclusion

In summary, Bzovey and Ngo's well-written and comprehensive review of the current research around both at-home and in-office treatments for MGD provides ECPs with great data to help manage existing and new patients with MGD. The results from this paper should spark change in our practice habits due to the evidence suggesting superiority of in-office procedures compared to conventional at-home treatments.

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