Contact Lens Update
CLINICAL INSIGHTS BASED IN CURRENT RESEARCH

Taking DED management to the next level

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Background

Dry eye disease is one of the most widely impacting ophthalmic conditions seen in clinical practice, adversely affecting ocular surface comfort and visual function, as well as impacting productivity at work and psychological health of many millions of patients globally on a daily basis.[1] Current lifestyle choices and challenges, including extended digital screen use, exposure to low humidity environments, as well as what we eat, drink, choose to take 'for our health', or apply to enhance appearance, are increasingly recognized to have an influence on the ocular surface.

In the absence of a cure, and with the efficacy of currently recommended patient-applied treatments often challenged, dry eye management remains an area deserving attention, to assist patients in maximizing their quality of life.

The Tear Film and Ocular Surface Society's second Dry Eye Workshop (TFOS DEWS II), published in 2017,[2] has made considerable strides towards meeting its goal of raising dry eye disease awareness amongst clinicians, researchers, the eye care industry, and the public. An exponential rise in the research publication rate in dry eye disease, reflects ongoing efforts to better understand its epidemiology and pathophysiology, and optimize its detection and management. Support from industry has driven a massive increase in the range of treatments available for managing DED.

Patient-applied therapy in the form of drops and lid hygiene remain the mainstay management options for dry eye disease (Figure 1),[3] but effectiveness is dependent on high levels of patient compliance, which are notoriously difficult to achieve with today's hectic pace of life. The demand for more rapid and effective solutions has thus driven a growing number and range of in-office therapeutic strategies.

Figure 1: Wide variety of products to manage dry eye disease

Therapeutic strategies for in-office application

Recognizing the critical contributory role that anterior blepharitis and meibomian gland dysfunction play in dry eye disease, in-office therapies focus largely on lid hygiene and improving the function of the meibomian glands. This may center around optimizing eyelid margin health to reduce bacterial load, freeing up the gland orifices, and warming the eyelids to melt the meibum and facilitate greater outflow.

Lid hygiene

While ongoing maintenance of good lid hygiene ultimately remains the responsibility of the patient, in-office devices and procedures that more thoroughly cleanse the lids and eyelashes, offer the potential to create a better starting point from which maintenance of good hygiene with patient-applied daily lid cleansing foams or wipes can more successfully achieved. The concept has been likened to the established dental hygiene model, where intermittent dental hygienist visits for a ‘scale and polish’ are supplemented with a daily tooth-cleansing and dental hygiene regime applied by the patient at home.

Lash crusting is a hallmark of seborrheic and staphylococcal blepharitis,[4] while cylindrical dandruff found encircling the base of the eyelashes is considered pathognomonic of Demodex blepharitis (Figure 2).[5]

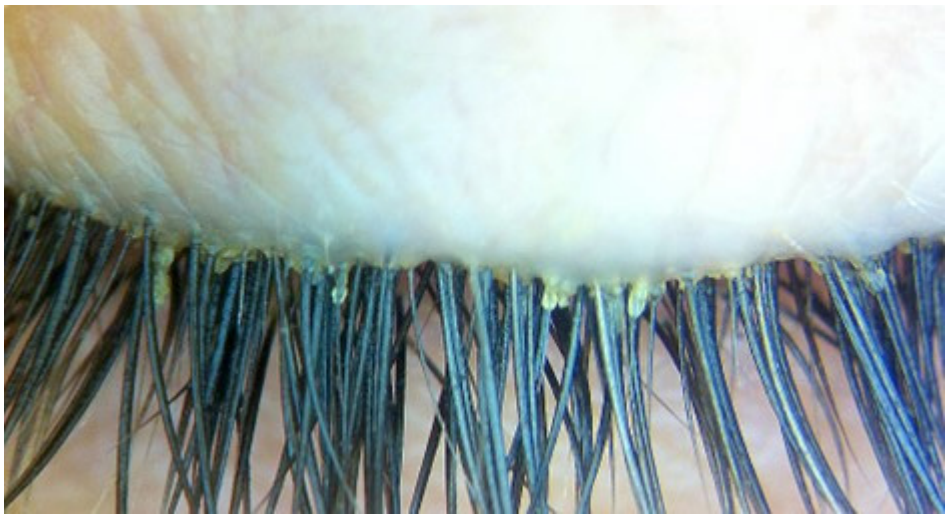

Figure 2: Cylindrical dandruff in a patient with Demodex blepharitis

A high bacterial load associated with anterior blepharitis is problematic, as exotoxins released by the bacteria contribute to destabilization of the tear film and trigger the vicious circle of dry eye disease.[6, 7] Crusting associated with long-standing anterior blepharitis, and especially cylindrical dandruff, can be challenging for patients to remove with wipes alone, and may reduce the chance of symptom resolution. Microblepharoexfoliation is a clinician-applied technique whereby a spinning foam tipped applicator, soaked in cleansing solution (often a tea-tree oil-containing product, if Demodex is implicated), is used to quickly and effectively remove debris from around the lashes,[8] which can reduce bacterial load and improve dry eye symptoms in contact lens wearers (Figure 3).[9, 10]

Figure 3: Microblepharoexfoliation to remove lid crusting

Improving gland orifice access

Often more intractable to remove than lash crusting, is lid margin keratin build-up, commonly referred to as 'hyperkeratinisation'. A common feature in MGD, this can occlude gland orifices and restrict meibum outflow. Effective debridement in such cases may be achievable using topical anaesthesia to soften the epithelial tissue and a golf club spud (epithelial debriding tool) to carefully debride the superficial keratinized epithelial tissue.[11] Lid margin debridement scaling is a simple in-office technique, requiring minimal additional resources, that has proven benefits in dry eye patients with MGD,11 including those with Sjögren Syndrome,[12] and those exhibiting shortened meibomian glands on meibography (Figure 4).[13]

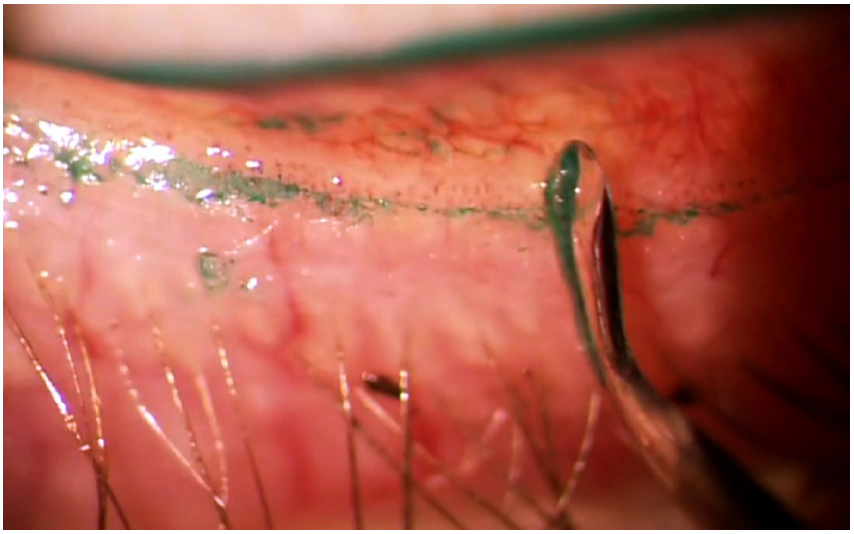

Figure 4: A golf-club spud removing keratinized epithelial tissue along the lower lid (debridement)

Meibomian gland intraductal probing is an invasive technique[14] that pierces the gland orifices and manually re-opens blocked glands, with the purpose of improving gland function but there remain anecdotal concerns about long-term safety and a randomized controlled trial was unable to confirm clinical efficacy.[15]

Gland warming

The melting point of meibum being raised above physiological eyelid temperature in MGD,[16] results in inspissated oils and promotes gland blockage, therefore in-office therapies commonly focus on improving gland function by warming the eyelids to melt the gland contents. Once warmed, meibum outflow may be facilitated via gland expression performed either as a step built into the in-office treatment, or independently via clinician-applied therapeutic gland expression after the lid-warming step.[17]

Heat can be applied externally to the eyelids, with or without compression, via a wide range of warm compresses, that may utilize heat generated by thermochemical reaction (Figure 5), contain microwave-heated seeds or glass beads, or apply latent moist heat (Blephasteam, Laboratoires Thea, France), via goggles.

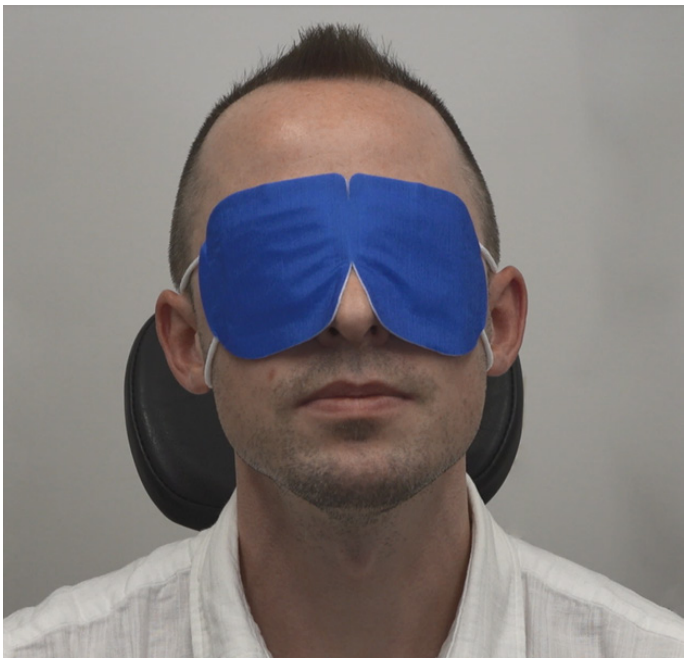

Figure 5: Lid warming mask (image courtesy of TFOS)

This can be used in-office, prior to therapeutic gland expression, for example, or may be recommended as an at-home treatment for patient self-application on a regular basis. Such therapies show similar efficacy, across a range of MGD severities, offering a choice of application strategy to suit individual patients.[18, 19] Without frequent rewarming, washcloths used as warm compresses fail to deliver the optimal temperatures of around 41°C for 10 minutes,[20] therefore the application of dedicated commercial devices that more consistently maintain the required temperature is recommended.[21]

Advanced thermal systems

To overcome challenges associated with reaching the optimal temperature at the site of the meibomian glands,[20] while protecting the surrounding tissues, a number of in-office devices opt to deliver heat to the eyelid via the palpebral conjunctiva, and offer assisted expression of the glands once warmed. The first thermal pulsation device to market, Lipiflow® (TearScience, Johnson and Johnson Vision) offers a bilateral 12-minute treatment and extended symptom relief and improvement in clinical signs of MGD from a single application in some patients,[22, 23] as well as prophylactic benefits in patients undergoing cataract surgery.[24, 25] The Systane iLux® device (Alcon, USA) is a hand-held in-office device utilising the same principle.

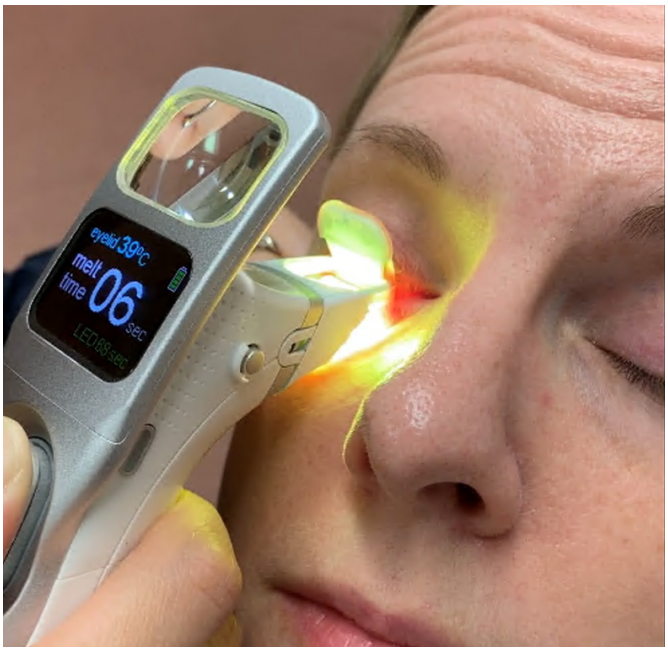

Figure 6: Alcon Systane iLux device in use (image courtesy of Dr Alison Ng)

With a built-in magnifying lens, it allows for clinician-guided application of heat and pressure, and shows similar efficacy to Lipiflow, up to 12 months post-treatment.[26, 27] The smaller device size and lower cost has the potential to facilitate more widespread adoption in clinical practice and increase access to thermal pulsation therapy for more patients. Another emerging in-office thermal option is the 'blink-assisted' TearCare® device, which delivers 15 minutes of heat to the meibomian glands via the tarsal conjunctiva, while permitting natural blinking. This is followed by manual gland expression. Studies have shown improved symptoms, tear film stability, and meibomian gland function up to 12 months following treatment for MGD,[28-30] and a recent prospective, investigator-masked, industry-sponsored multicentre trial comparing TearCare head-to-head with LipiFlow suggests comparable efficacy in mild-to-moderate MGD and possibly superior performance from the TearCare device in more severe cases.[31] Further well-controlled, long-term efficacy studies of the various thermal systems are warranted.[32]

Intense pulsed light therapy

Intense pulsed light (IPL) therapy involves the application of trained pulses of high intensity, non-coherent long wavelength light (580-1200nm) that is selectively absorbed by chromophores at specific depths within the tissue to which it's applied, without damaging surrounding tissue (Figure 7).

Figure 7: IPL device in use (image courtesy of Dr Etty Bitton)

Used widely in dermatology for the treatment of rosacea and other skin conditions,[33] IPL has more recently also demonstrated benefits in the management of MGD.[34] While the mechanism(s) of action remain incompletely understood, a course of treatments applied several weeks apart, offers cumulative benefits in meibomian gland function, tear film quality and dry eye symptom amelioration.[35, 36] A reduction in inflammatory mediators has been demonstrated,[37] as well as a reduction in Demodex infestation in some,[38] but not all,[36] studies. Outcomes between different IPL devices might vary,[39] but more research is required to understand possible impacts relative to patient selection, light pulse profile, fluence, and delivery protocol. Benefits from IPL application have been confirmed independently of therapeutic gland expression,[35, 36] but most often therapeutic gland expression is performed immediately post-IPL application for synergistic effect.[40] Systematic reviews evaluating IPL safety and efficacy highlight the need for further high-quality research in this area,[41] but increasingly suggest promising outcomes in MGD.[42, 43]

Low-level light therapy

Photobiomodulation, or low-level light therapy (LLLT) using red or near infra-red radiation has become available in recent years as a therapy for MGD, used either independently or as an adjunctive therapy for application in combination with IPL (Figure 8).

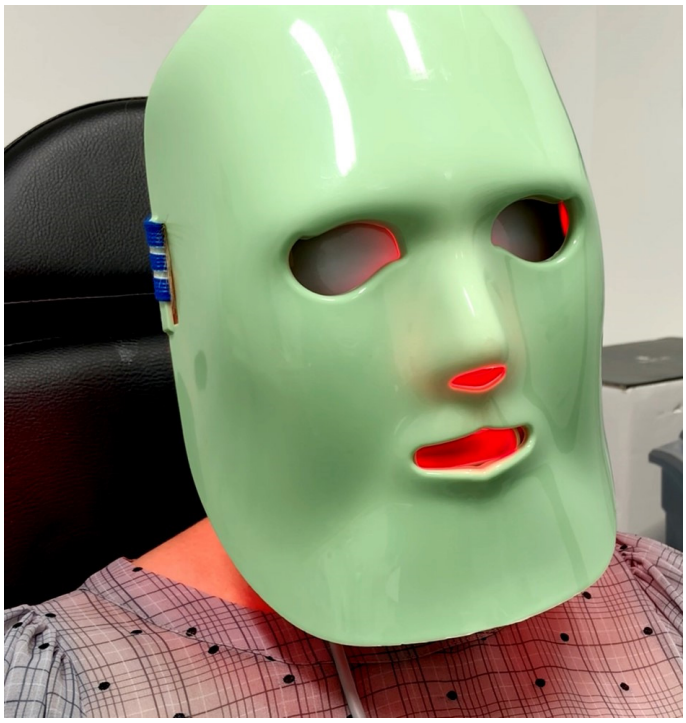

Figure 8: Low level light therapy device in use

Its proposed mechanisms of action include promotion of wound healing, reduction of inflammation and management of pain.[44] A systematic review focusing on the therapeutic efficacy of LLLT in combination with IPL, concluded that a lack of high-quality evidence limited the confidence with which reported benefits could be interpreted. [45] A recent prospective, investigator-masked, randomized head-to-head trial comparing IPL (Eye-Light, Espansione Marketing S.p.A., Bologna, Italy) with LLLT (MY MASK-E, Espansione Marketing S.p.A., Bologna, Italy) confirmed subjective improvements with both devices, that were greater with the LLLT, 2 weeks after completion of a course of 4 treatments, but found no significant improvement in objective MGD markers with either device.[46] As well as the short study duration, study limitations include the lack of a sham group, which presents a high risk of a placebo effect.

Quantum molecular resonance

Quantum molecular resonance (QMR) therapy (Rexon-Eye, Resono Ophthalmic, Italy) is another novel therapeutic strategy proposed as a treatment for dry eye disease. It involves the topical application of electrical currents in the frequency-specific range of 4–64 MHz, which is hypothesised to stimulate metabolism and natural regeneration of biological tissues.[47, 48] Open label trials report symptomatic and clinical improvements,[49] and demonstrate reduced ocular surface inflammation in mixed-type dry eye disease.[50] However, the predominantly short-term, unmasked, and non-randomised nature of existing studies demands further evidence to confirm efficacy, from well-controlled, longer-term studies with a reduced risk of bias.

Conclusions

While the plethora of therapies for managing dry eye provides a far wider range of therapeutic possibilities for managing DED than ever before, it must be remembered that no ‘one size fits all’ approach to successful dry eye management exists. Clinicians are cautioned against purchasing costly management devices at the expense of diagnostic equipment, as it is important to target treatment to the identified deficiency(ies).[51] Following dry eye diagnosis according to consensus criteria,[52] dry eye subtyping assists in selection of the most appropriate

treatment(s), recognizing that a multimodal approach may be appropriate to address multiple identified deficiencies.

The concept of the vicious circle of dry eye disease helps explain the impact of certain tear film deficiencies.[7] Tear film instability due to MGD-related lipid insufficiency triggers the vicious circle and, without resolution, will ultimately manifest as ocular surface inflammation and cellular damage, as well as reduced tear volume due to excessive tear evaporation. By breaking the vicious circle, the impacts on the ocular surface have the potential to be reversed such that improving meibomian gland function alone, may be sufficient to resolve downstream inflammation and restore normal tear volume.

Even after the application of in-office treatments, the importance of ongoing maintenance by patients in regard to their lid hygiene cannot be underestimated. As yet, there is no cure for dry eye disease, therefore ongoing at-home care may be indicated to optimize outcomes. Regular review of patients is critical to enhance patient engagement and their compliance in managing the chronic condition to which they are predisposed. Follow up allows current management plans to be re-evaluated and refined as necessary.

Finally, it's important for clinicians to be familiar with the literature and to review the highest-level evidence regarding the rationale for, and the safety and efficacy of the latest, often heavily-marketed products. More research is needed to confirm relative benefits of different treatments through head-to-head studies, to be able to predict the most suitable treatment based on presenting characteristics, and to estimate duration of effect.

While in-office procedures don't negate the need to take an individualized approach, applied thoughtfully, they offer an exciting advance in dry eye management that may overcome the need for daily at-home therapy and help reduce dependence on patient compliance.

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