

Dry eye treatment: choosing the best product for your patient

Abstract

Dry eye disease (DED) is a multifactorial condition that is complex to diagnose and treat. Over the last two decades, major advances have occurred in the treatment of DED and ocular surface disease. There has also been an equal increase in knowledge concerning the processes or mechanisms whereby the condition develops and progresses. This has led to a paradigm shift in DED management from simply lubricating and hydrating the ocular surface with artificial tears to strategies that stimulate natural production of tear constituents, maintain ocular surface epithelial health and barrier function, and inhibit the inflammatory factors that adversely impact the ability of the ocular surface and glandular epithelia to produce tears. Preliminary experience with this new therapeutic approach suggests that quality of life can be improved for many patients with dry eye, and that initiating these strategies early in the course of the disease may prevent potentially blinding complications of DED.

Dry eye disease (DED) is a major public health problem that is likely to intensify in the future as a result of an ageing population and modern lifestyles (Aquavella, 2013; Schein et al, 1997; Moss et al, 2004). Recent improvements in our understanding of DED hold promise for the development of new therapies to aid in treatment and improve the quality of life for people with dry eye (Niimi et al, 2013).

DED is caused by conditions that increase evaporation of the tear film or decrease tear production (Tomlinson et al, 2006). The resulting increase in tear film osmolarity (hyperosmolarity) can lead to inflammation of the ocular surface and symptoms such as (Tsubota et al, 1999):

- Dryness
- Burning or stinging
- Ocular grittiness
- Foreign body sensation
- Blurred or fluctuating vision
- Watery eyes
- Photophobia.

In order to stabilise the tear osmolarity in dry eyes, a number of artificial lubricant eye drops are available for mild, dry and irritated eyes. Studies by Waduthantri et al (2012) have shown relief of subjective symptoms in a patient, but no objective signs of improvement with lubricant drops with a gel agent. However, knowledge of the effectiveness of these lubricants on the tear osmolarity is

relatively unexplored due to the large number of variations of substances. Still, we can provide good care to our patients. With correct diagnosis and a sound understanding of the problem, there are a broad spectra of options on hand (*Table 1*). This article explores how to choose the best product for the various forms of dry eye and how to help the patient to deal with the problem.

Management and treatment

The first step of DED treatment is properly identifying the cause of the patient's dry eye condition, such as aqueous dry eye deficiency or evaporate dry eye. This should be carried out together with symptom assessment (DEWS Research Committee, 2007):

- Frequency—how often a symptom is expressed
- Severity—how bad or disabling the symptom is
- Interference with activity—how DED affects the person's ability to carry out specific work or home-based tasks (*Figure 1*).

Dry eye evaluation must also be multifaceted. In addition to assessing tear volume, quality, and stability, it is necessary to interpret staining patterns and complete a full lid evaluation to rule out the presence or co-existence of blepharitis. There are overlaps of many symptoms of DED and blepharitis, so careful clinical evaluation is of utmost importance. After a properly executed evaluation, a treatment model could be applied according to severity (*Figure 2*) (*Table 2*).

Lubricants

Tear supplements are often referred to as 'artificial tears'. This is an incorrect or unsuitable name for most products that describe themselves as such, as these supplements do not mimic the composition of human tears and mostly function as lubricants.

Table 1. Dry eye treatment options

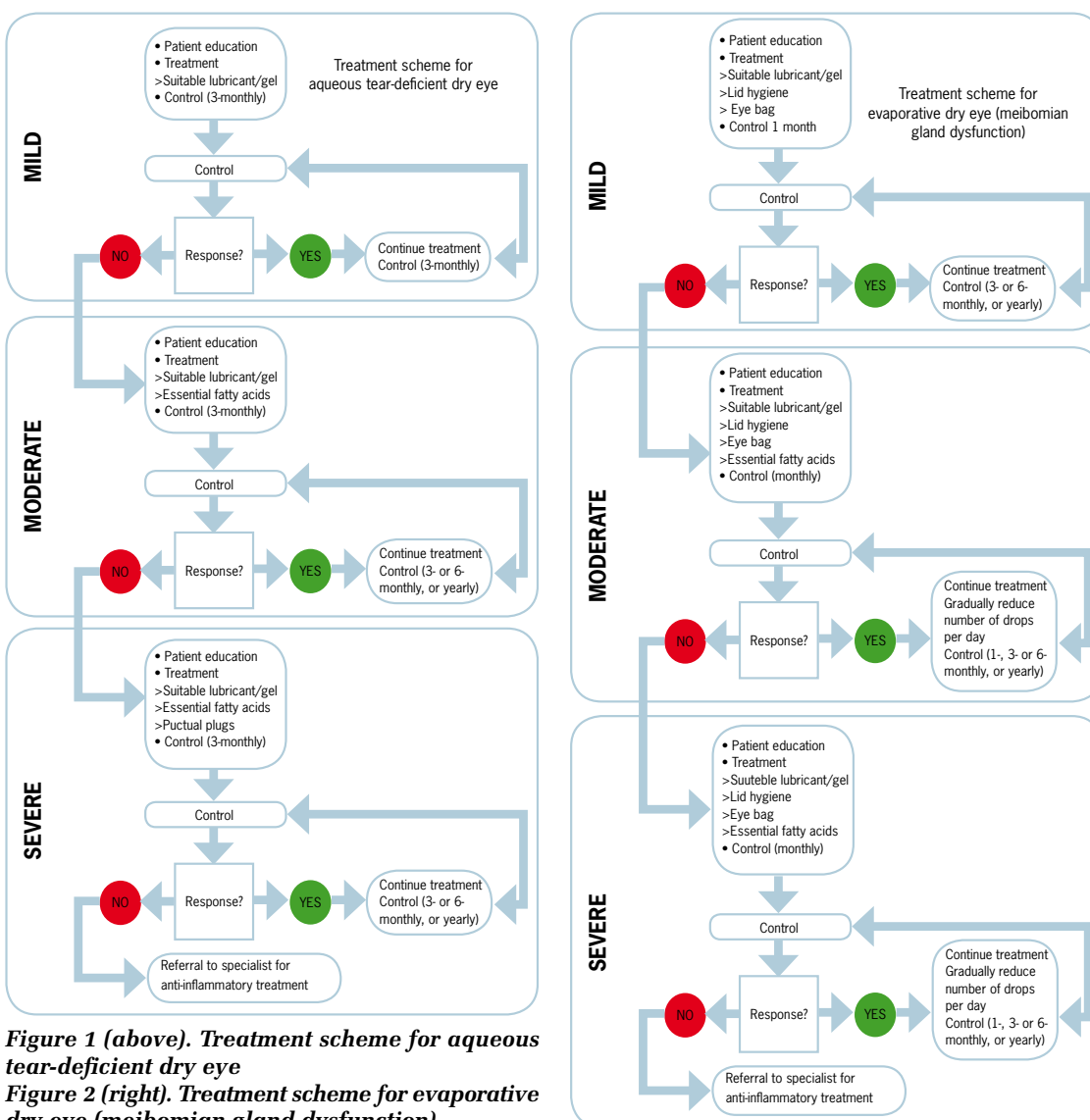
- Artificial tear substitutes
- Anti-inflammatory agents, including cyclosporin A, corticosteroids and omega-3 fatty acids
- Tetracyclins
- Plugs
- Contact lenses
- Lid wipes
- Air moisturisers

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Table 2. Dry eye severity grading system

Dry eye severity	1	2	3
Discomfort, severity and frequency	Mild to episodic and occurs under environmental conditions and stress	Moderate and episodic to chronic, with or without stress	Severe and frequent to constant, without stress
Visual symptoms	None to mild and episodic, with or without fatigue	Narking and/or episodically limiting different activities	Narking and/or constantly limiting different activities
Conjunctival injection	None or mild	None or mild	+/- to +/++
Conjunctival staining	None to mild	Varying	Moderate to marked
Corneal staining	None to mild	Varying	Marked, central
Conceal and tear signs	None to mild	Debris and low tear meniscus	Filamentary keratitis with mucus clumping and raised tear debris
Signs of lid and meibomian gland dysfunction (MGD)	MGD variably present	MGD often present	MGD fequently present
Non Invasive Break Up Time	Varying	≤10 seconds	≤5 seconds



In the recent past, however, some formulations (e.g. TheraTears® and Blink Intensive Tears®) have aimed to mimic the electrolyte composition of human tears (Gilbard et al, 1989; Gilbard, 1994).

Supplements containing electrolytes have been shown to be effective in treating ocular surface damage due to dry eye (Gilbard and Rossi, 1992; Lopez Bernal and Ubels, 1993). Tear supplements can be characterised as hypotonic or isotonic buffered solutions, containing electrolytes, surfactants and/or a versatility of viscosity agents. The ideal solution should be preservative-free, contain electrolytes and polymers to prolong its time on the ocular surface (Holly and Lemp, 1971; Ubels et al, 1995).

Tear supplements are generally the first-line therapy in patients with DED (Figure 3). Unfortunately, a large proportion of practitioners prescribe tear supplements as the only solution to patients expressing symptoms of DED. Therefore, it is worth considering following statements published in the Dry Eye Workshop (DEWS) (DEWS Research Committee, 2007: 165) report:

'For patients with moderate to severe dry eye disease, the absence of preservatives is of more critical importance than the particular polymeric agent used in ocular lubricants.'

'For patients with dry eyes, even vanishing preservatives may not totally degrade due to the decrease in tear volume and may be irritating.'

Medical products

Grounded on the concept that inflammation is a cardinal factor of the pathogenesis of dry eye, the capacity of several anti-inflammatory agents for treatment of DED has been evaluated in clinical trials.

Cyclosporine

Clinical improvement from cyclosporine A has been observed in several trials (Sall et al, 2000; Kunert et al, 2002). After treatment with 0.05% cyclosporine, a significant decrease in the number of cells expressing the lymphocyte activation markers was found, showing less activation of lymphocytes compared with eyes treated without the active ingredient (Kunert et al, 2000).

Corticosteroids

Corticosteroids are an effective anti-inflammatory therapy in DED, and clinical improvement of keratoconjunctivitis sicca has been found after treatment with anti-inflammatory agents, including corticosteroids (Pflugfelder, 2004).



Figure 3. Tear supplements are generally the first-line therapy in patients with dry eye



Figure 4. A silicone punctal plug inserted in the lower eyelid

Tetracyclines

The antimicrobial effect of oral tetracycline treatment has been discussed in several studies (Dougherty et al, 1991; Solomon et al, 2000; Shine et al, 2003). These studies hypothesise that a reduction in the lipolytic exoenzymes bacterial flora and suppression of lipase production with an outcome of decreased in meibomian lipid breakdown may contribute to improvement in dry eye-associated diseases. Many ideas on how to deal with the use of tetracycline and its derivatives have been suggested. However, a safe but adequate option in management is still needed due to the potentially hazardous effects of extended use of oral antibiotics (Aronowicz et al, 2006).

Essential fatty acids

Essential fatty acids are vital for health. Fatty acids cannot be synthesised in vertebrates and must come from dietary sources. The two fatty acids known to be essential for humans are omega-3 and omega-6 fatty acids. In a typical Western diet, intake of omega-6 fatty acids is 20–25 times that of omega-3 fatty acids. Omega-6 fatty acids are precursors for

arachidonic acid and certain proinflammatory lipid intercessors. In contrast, some omega-3 fatty acids (e.g. eicosapentaenoic acid [EPA] found in fish oil) suppress the synthesis of these lipid mediators and block production of the protein Interleukin-1 alpha and the cytokine, tumor necrosis factor alpha (Endres et al, 1989; James et al, 2000).

A positive result of omega-3 fish oil on rheumatoid arthritis has been demonstrated in various clinical trials (James and Cleland, 1997; Kremer, 2000), where significant improvement in ocular irritation symptoms, lissamine green staining and decreased conjunctival staining was observed (Barabino et al, 2003).

Supplementary resources

Punctal plugs

A review on punctal plugs has reported that in major eye clinics, punctal plugs are considered indicated in patients who have dry eye symptoms (Figure 4), demonstrating a Schirmer's test (with ocular anesthesia) result less than 5 mm at 5 minutes and showing evidence of ocular surface dye staining (Baxter and Laibson, 2004).

Contraindications for punctal plugs include allergy to the materials and punctal ectropion. It has been further suggested that plugs may be contraindicated in dry eye patients with ocular surface inflammation, as well as acute or chronic infection of the lacrimal canaliculus or lacrimal sac (Baxter and Laibson, 2004).

Contact lenses

Contact lenses may be helpful in dry eye conditions by protecting and hydrating the corneal surface (Figure 5). Several different lens materials and designs have been evaluated, including silicone lenses and gas-permeable scleral hard contact lenses (Bacon et al, 1994; Pullum et al, 2005).

Moisture chamber spectacles

Several studies have described the relationship between environmental humidity and dry eye. Korb et al (1996) report that moisture chamber spectacles increased the periocular humidity and significantly increased tear film lipid layer thickness (Figure 6).

Air humidifiers

The optimal relative humidity may differ for the eyes regarding desiccation of the mucous membranes. Sustained low relative humidity causes impairment of the precorneal tear film and studies indicate that relative humidity below 40% is better for the eyes than levels below 30% (Wolkoff and Kjaergaard, 2007). To optimise indoor conditions, an air humidifier could be beneficial for DED (Figure 7).



Figure 5. Contact lenses may be helpful by protecting and hydrating the corneal surface



Figure 6. Moisture chamber spectacles increase periocular humidity and tear film lipid layer thickness



Figure 7. Air humidifiers can be used to optimise indoor conditions for patients with dry eye

Lid wipes

Lid hygiene is the main treatment for meibomian gland dysfunction (MGD). Other therapies include (Dougherty et al, 1991; Smith and Flowers, 1995):

- Oral tetracycline, doxycycline, or minocycline
- Topical erythromycin or bacitracin
- Topical steroids.

The cost and side effects associated with some of these medications, however, make them a poor choice for long-term treatment in patients with mild to moderate cases of MGD. In such cases, conservative treatment with the use of lid hygiene is recommended (Romero et al, 2004) (*Figure 8*).

Lid warming and massage

Meibomian gland dysfunction and obstruction are often considered the prime causes in the etiology of dry eye conditions. Eyelid warming, where the application of heat to the external eyelid surface increases the temperature of the meibomian glands, has shown considerable clinical value (Mori et al, 1999; Olson et al, 2003) (*Figures 9 and 10*). For those who wear contact lenses, this therapy also provides an effective method to improve and maintain the function of meibomian glands, improving oil secretion and contact lens wearing tolerance (Olson et al, 2003).

Patient education

The best way to ensure that patients remember what was said in the practice is with appropriate verbal communication. If the message is too scientific or descriptive, it may not register with the patient. In today's computerised society, patients tend to look for information about their condition on the internet. Thus, it is critical that verbal instructions are supplemented with brochures or links to websites where patients can get accurate information.

The health professional should design a treatment scheme, emphasise the importance of adhering to this and schedule a follow-up control visit within 1–3 months, depending on treatment regimen. This gives the patient time to form the habit of:

- Using lubricants,
- Including essential fatty acids in their diet
- Performing the lid hygiene routine.

Scheduling a follow-up visit will also help to ensure that they do not become disinterested or run short of the product advised.

The health professional should also ensure that the patient understands that treatment of DED is a dynamic process that may require change in management. Patients need to understand what to do if circumstances worsen and/or symptoms change and or return.



Figure 8. Conservative treatment with the use of lid hygiene is often recommended



Figure 9. Eyelid warming



Figure 10. Massage combined with eyelid warming can improve the function of meibomian glands

Conclusions

DED is commonly encountered in practice. Health professionals must use a thorough case history of symptoms in conjunction with a variety of clinical and diagnostic tests to diagnose the condition and its severity. Treatment options should be approached systematically and be evidence-based, according to symptoms and signs of severity. Dry eye is a chronic disease that can be frustrating for both patient and practitioner. In our 'quick fix' society, this is a disease process that does not play by those rules. **IJOP**

Conflict of interest: none declared.

Key points

- Dry eye disease (DED) is commonly encountered in everyday practice
 - The first step of DED treatment is properly identifying the cause of the patient's dry eye condition
 - Dry eye evaluation should include an assessment of tear volume, quality and stability. It is also necessary to interpret staining patterns and complete a full lid evaluation to rule out the presence or co-existence of blepharitis.
- Dry eye disease • Tear film • Tear production • Lubricant

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