Dry eye management
The TheraTears Way

Andrew Matheson describes how he came to distribute TheraTears in the UK and what further products are currently expanding the range

I FIRST ENCOUNTERED the original TheraTears eye drop preparation in 1996 at an Academy of Optometry conference when I met its inventor, Jeffery Gilbard, MD. He had launched the product one year earlier.

TheraTears had evolved after many years of research at the Schepens Eye Institute. There was some European scepticism about the product's claims at the time.

This proved to be unfounded. TheraTears lubricant eye drop sales have improved year on year and are currently sold all over the world. I personally have had massive success with the TheraTears range of products in my dry eye practice and, three years ago, I was invited to distribute them in the UK.

There are currently four TheraTears products available, the original TheraTears Lubricant Eye Drops, TheraTears Liquid Gel, TheraTears Nutrition and TheraTears Sterilid. I will now detail the properties of each in turn.

Standard TheraTears drops are both hypotonic and electrolyte balanced. In dry eye, especially evaporative dry eye, tear tonicity increases. In dry eye, water is then lost from the ocular surface to the hypertonic tears by osmosis. The conjunctiva is the first to suffer, with a reduction in the amount of mucus-secreting goblet cells. An intact mucous film is required to hold the aqueous component of the tears in place.

The hypotonicity of TheraTears drops has been chosen to restore the tear tonicity to a level that encourages goblet cell repopulation of the conjunctiva. This effect is greater if the patient has punctal plugs fitted as the optimised tonicity is maintained for much longer (Figures 1a and 1b).

The importance of electrolyte balance has been reported extensively elsewhere.[1-2] The ocular surface epithelium is unique in that it does not have a blood supply. It derives its electrolytes and oxygen from the tear film.

The tear film, in other words, is a vital fluid and, as such, the electrolyte balance of that fluid is crucial for biological function. The electrolytes in eye drops need to match those of the tear film. Research shows that unless an eye drop has an electrolyte balance that precisely matches that of the human tear film, there is a loss of conjunctival goblet cells (conjunctival goblet-cell density is a very sensitive indicator of ocular surface health, and goblet cells provide the natural lubrication for the ocular surface).[4]

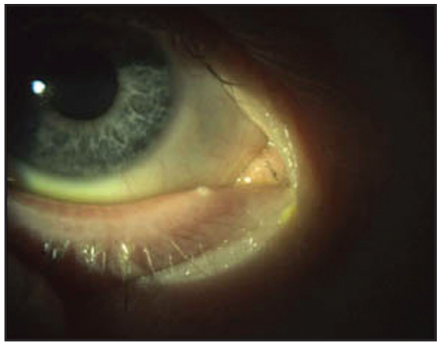

FIGURE 1a.

The good news is that using better-balanced lubricant eye drops helps to restore the ocular surface. In the 1980s, Wilson, O'Leary and Bachman found they could decrease the corneal desquamation caused by preservative-free sodium chloride by adding certain electrolytes to the solution.[7]

Electrolyte balance is crucial for maintenance of conjunctival goblet cells – for example, if sodium levels are too high, or if bicarbonate levels are too low, mucus-containing goblet cells are lost. In an independent clinical study[8], TheraTears was shown to restore conjunctival goblet cells in dry eye seen after Lasik vision correction surgery. Patients were treated with the TheraTears solution at least four times a day and, at night, one drop of a 1 per cent carboxylmethyl cellulose solution was applied.

Controls were treated with a preservative-free balanced salt solution. At one week and one month, 87.5 per cent and 100 per cent respectively of TheraTears-treated patients were free of dry eye symptoms, while only 12.5 per cent and 20 per cent of control-treated patients were symptom free.

FIGURES 1a and b. Punctum plug fitting enhances goblet cell repopulation in conjunction with TheraTears' users

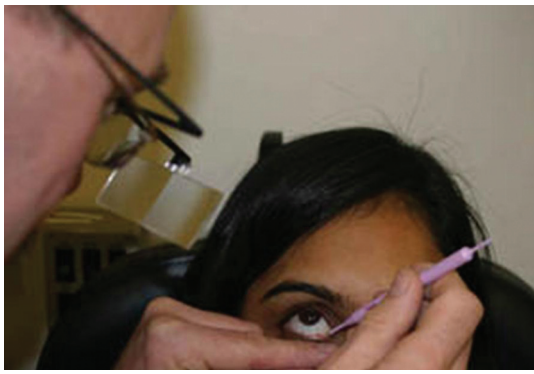

FIGURE 1b.

When the authors looked at goblet cell density by impression cytology after one month of treatment, the TheraTears solution was shown to significantly restore conjunctival goblet-cell density while treatment with preservative-free control did not.

TheraTears Liquid Gel is four times more viscous than the standard drops and shares the patented electrolyte balance properties. This is especially important for a gel product as it is in contact with the eye for longer. This is shown in Table 1.

Both products are approved for use with contact lenses. I, however, find that the standard product is better suited in most cases.

TheraTears Nutrition, a highly refined patent pending eicosapentaenoic acid (EPA)-enriched flaxseed oil, is soon to arrive from the US and holds great promise for our evaporative dry eye and meibomian gland dysfunction/blepharitis patients.

By decreasing inflammation, and augmenting the oil and water layers of the tear film, omega-3 supplementation with EPA-enriched flaxseed oil promises to provide the foundation for a broad spectrum of dry eye treatment regimens.

There is an abundance of clinical evidence that ingestion of omega-3s decreases the inflammation seen in the joints in rheumatoid arthritis[3-6] and in dermatitis as well.[7] Not surprisingly, given

the cartilaginous tarsal plate, reports are emerging to indicate that consumption of omega-3s decrease the inflammation of meibomitis. As a result, meibomitis patients taking omega-3 supplements have experienced relief from eye irritation upon awakening in the morning.[8]

The EPA from fish and flaxseed oils is elongated by enzymes to produce the anti-inflammatory prostaglandin PGE3 and the anti-inflammatory leukotriene LTB3. EPA and docosahexaenoic acid and alpha-linolenic acid (ALA) from flaxseed oil competitively inhibit the conversion of omega-6s to arachidonic acid (AA) thereby reducing inflammation by this pathway. Production of PGE1 is also stimulated.

Why is this desirable? Firstly, prostaglandin PGE1 has anti-inflammatory properties,[10,11] further helping to reduce meibomitis and associated ocular surface inflammation. More importantly, PGE1 acts on G protein-coupled receptors designated E-prostanoid or 'EP' receptors.

Specifically, PGE1 binds to EP2 and EP4 receptors to activate adenylate cyclase to increase cyclic AMP (cAMP).[12] PGE1 has been shown to stimulate aqueous tear production in rabbits[13] and cAMP has been shown to stimulate aqueous tear secretion in dry eye patients.[14,15]

Secondly, essential fatty acids are used by the meibomian glands in the eyelid to manufacture the oil layer of the tear film. High performance liquid chromatography/mass spectrometry studies have shown that the polar lipid profiles of meibomian gland secretions in female Sjögren's patients are controlled by the dietary intake of omega-3 essential fatty acids. Patients with high intakes of omega-3s show a single-prominent-peak polar lipid pattern whereas patients with low dietary intake show multiple smaller peaks.[9] It seems reasonable to surmise that dietary omega-3s are being utilised in the production of meibomian secretions and are contributing to and augmenting the tear film oil layer.

Clinical reports have observed clearer and thinner oils with omega-3 treatment.[8] With an improved supply of omega-3s, the oils produced by the meibomian glands flow better and therefore create a better

Figure 2. Use of Sterilid, a novel lid hygiene foam

oil layer covering for the tear film. The improvement of the oil layer provides dry-eye relief for patients with meibomian gland dysfunction.

There have been some attempts to treat dry eye with the omega-6 essential fatty acid gamma linolenic acid (GLA), found in blackcurrant seed oil, evening primrose oil and borage oil. There are two published studies that concluded GLA was not effective in treating dry eye.[16,17] Moreover, there are risks in long-term GLA and omega-6 supplementation related to the accumulation of arachidonic acid (inflammation, thrombosis and immunosuppression).[18-20]

TheraTears Sterilid is another exciting dry eye product that has just arrived in the UK (Figure 2). It is a foaming lid hygiene product with bactericidal properties and is used in the US not only for blepharitis/meibomian gland dysfunction patients but also as a pre-surgery treatment to reduce the risk of infection during surgery, especially Lasik and cataract operations. Contact lenses are removed prior to use.

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Table 1

	Theratears Eye drops	Theratears Liquid Gel
Carboxymethylcellulose	0.25%	1.00%
Viscosity (cps)	6.5 'Natural Tears' like	49 Extra cushioning
For use with	DW and EW soft lenses	GP lenses & continuous/EW lenses at Bedtime
Delivery system	Preservative free single-use	Preservative free single-use

Andrew Matheson is a therapeutic optometrist specialising in dry eye treatment. He is also director of Matheson Optometrists, sole importer of the Theratears range of products. These can also be obtained through Mid-Optic