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There's Nothing Fishy About Omega-3 Fatty Acids for Dry Eye Syndrome

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Dry Eye Syndrome: Background, Prevalence, and Causes

Background and Prevalence of Dry Eye Syndrome

Dry eye syndrome (DES) is a common affliction that presents to the ophthalmologist. The ocular discomfort, burning, stinging, vision blurring, and other symptoms affect more than 7.5% of US men age 80 years and older[1] and nearly 10% of US women age 75 years and older.[2] These symptoms measurably affect activities of daily life, such as reading, using a computer, driving, and watching television.[3]

DES is a multifactorial disease that has, at its essence, some deficiency or abnormality of the ocular tear film. The tear film has 3 main layers.

The first layer is a superficial layer of lipids approximately 0.1 µm thick. This hydrophobic, oily layer is primarily produced by the meibomian glands, and its chief function is to reduce evaporation of the underlying aqueous layer.

The second and thickest layer is the aqueous layer. It is approximately 7 µm thick. The aqueous layer is produced by the main and accessory lacrimal glands. It hydrates the ocular surface and provides a smooth refractive surface for light entering the eye.

The final, thinnest layer is the mucin layer. Approximately 0.05 µm thick, this layer is produced by the goblet cells in the conjunctiva. Its lipophilic properties allow it to spread evenly over the epithelial membranes of the ocular surface. The mucin layer also has hydrophilic properties, allowing the overlying aqueous layer to spread evenly over it.

Causes of Dry Eye Syndrome

DES is most commonly thought to be due to aqueous tear deficiency as a result of insufficient aqueous tear production. Age plays a role in aqueous tear deficiency, with decreased production of aqueous tears and atrophy of the lacrimal glands occurring with age, especially in postmenopausal women. Another dominant cause of DES is evaporative dry eye, where the lipid layer cannot sufficiently inhibit the aqueous layer from evaporating. A meibomian gland dysfunction is usually present in evaporative dry eye. Both entities (aqueous tear deficiency and evaporative dry eye) result in increased osmolarity of the tear film and subsequent inflammation of the aqueous surface.

Mucin abnormalities may occur in cases such as chemical injury to the eye or in diseases such as Steven-Johnson syndrome. With a poor mucin layer, the overlying aqueous layer cannot adequately cover the ocular surface, leading to epithelial damage from dessication.

Dry Eye Syndrome: Treatments

Treatment Mainstays of Dry Eye Syndrome

The mainstay of treatment for aqueous tear deficiency is to rehydrate and lubricate the ocular surface with topical lubricants. Lubricant eye drops (artificial tears), lubricant eye gels, and lubricant eye ointments are all available over the counter to help increase or maintain lubrication of the ocular surface and decrease symptoms. By supplementing the available tears, lubricant eye drops help to rehydrate the ocular surface and to protect it from dessication.

Another treatment option is the insertion of punctal plugs. Punctal plugs help prevent drainage of the tear film down the lacrimal drainage system, thereby keeping more of the tear film on the ocular surface and rendering it less prone to suffer ill effects from dryness. However, if the tear film is unhealthy in any way, such as having proinflammatory mediators, the punctal plugs may actually worsen the patient's symptoms.

Anti-inflammatory therapies, such as topical cyclosporine, may help increase production of aqueous tears by decreasing the infiltration of inflammatory cells into the lacrimal glands. With increased production of aqueous tears and fewer inflammatory compounds on the ocular surface, patients are less prone to have DES symptoms.

The critical role of the meibomian glands in DES is becoming more and more appreciated.[4] In patients with meibomian gland dysfunction, tetracycline and its analogues doxycycline and minocycline have helped to stabilize the lipid layer of the tear film, thereby improving evaporative dry eyes. They work by decreasing the bacterial load on the eyelid; with fewer bacteria, there is less degradation of the lipids produced by the meibomian glands, and less inflammatory waste is produced.

Omega-3 Fatty Acids as Treatment for Dry Eye Syndrome

Similarly, the essential omega-3 fatty acids, such as eicosapentaenoic acid (EPA) and docosahexanoic acid (DHA) found in fish oil and alpha-linoleic acid (ALA) in flax seed oil, are also thought to improve evaporative dry eye. Omega-3 fatty acids are believed to competitively inhibit the production of proinflammatory mediators, such as interleukin-1 and tumor necrosis factor-alpha. With fewer proinflammatory compounds available, the ocular tear film is thought to be able to better promote a healthy ocular surface. A higher intake of omega-3 fatty acids has been associated with a decreased incidence of DES in women.[5]

Some relatively common side effects of omega-3 supplementation (especially fish oil supplements) include "fish oil burps," upset stomach, and bad aftertaste. These can usually be alleviated by taking supplements with enteric coatings to delay the release of the oils until they are out of the stomach and in the lower intestine.

Widely available over the counter, omega-3 fatty acids are commonly found in a gel capsule and are usually provided in an ethyl ester form instead of their naturally occurring triglyceride form. This ethyl ester form is easier to work with during industry processing and distillation to remove contaminants and impurities. Unfortunately, the bioavailability of ethyl ester form is reduced to as low as 20% (up to 60% with a high-fat meal). This compares poorly with the triglyceride form's absorption of 69% (increasing to 90% with a high-fat meal).[6] This increased bioavailability results in 50% more plasma EPA and DHA when the acids are administered as a triglyceride rather than an ethyl ester.[7]

Conclusion

Given their beneficial effects on decreasing inflammation in the body, the essential omega-3 fatty acids EPA, DHA, and ALA play a role in treating DES. Although it is less widely available, patients may experience additional benefits from the triglyceride form of omega-3 supplementation because of its increased bioavailability when compared with the more commonly available ethyl ester form. Alternatively, patients may be able to decrease their total dose when using the triglyceride form, thereby reducing any untoward side effects.

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