

Nutrition for Dry Eye Disease: An Executive Summary

Dry Eye Disease (DED) has become not only a significant quality-of-life issue but has shown to be a very real disease process. Whether it's called Dysfunctional Tear Syndrome, Chronic Dry Eye, or Dry Eye Syndrome it's a condition whereby the anterior surface of the eye is not properly maintained and/or the patient is experiencing an uncomfortable feeling of their eyes.

Essential Fatty Acids: Good Fats for Eye Health

Essential Fatty Acids (EFAs) are involved with producing life energy in our bodies from food substances, and moving that energy throughout our systems. They govern growth, vitality, and mental state. They hook up oxygen, electron transport, and energy in the process of oxidation. EFAs are also important in oxygen transfer, hemoglobin production, and control of nutrients through cell membranes. They markedly shorten recovery time from fatigue. EFAs are also a key in preventing damage from hard fats because they are "anti-sticky" and tend to disperse them. EFAs play a part in almost every function of our body. Humans do not produce fatty acids; therefore they must be obtained from the diet. The essential fatty acids we will address in this discussion are Omega-6 and Omega-3.

Omega-6 fatty acids are the most plentiful in our diet. They are in most everything we eat that contains fat, including meat, vegetable and seed oils, dairy products and eggs. Omega-3 fatty acids are available in many seed oils and most all cold-water fatty fish. A proper balance of these fatty acids is essential to good health. The daily intake recommendation of the Institute of Medicine is 4:1 - four times as many Omega-6 fatty acids as Omega-3 fatty acids. It is currently estimated that the average American diet maintains a ratio of 25:1!

Omega-6 fatty acids are suggested to metabolize to the site-specific anti-inflammatory eicosanoid, prostaglandin E1 (PGE1). These particular prostaglandins are suggested to reduce ocular surface inflammation, as well as reduce the inflammatory process associated with meibomianitis and reduced lacrimal gland aqueous output. Omega-6 fatty acids have been given a bad rap by well-meaning, but misinformed medical writers. It is true that the typical American diet is overloaded with omega-6 linoleic acid (LA) from vegetable oils such as sunflower, safflower, corn, cottonseed, and soybean oils, which are added to nearly all processed foods.

However, good health also depends on omega-6 gamma linolenic acid (GLA), which is a downstream metabolite of omega-6 linoleic acid, and is found in sources such as black currant seed oil, borage oil, and evening primrose oil. This compound is a necessary component in the downstream metabolism of omega-6 fatty acid to the series one anti-inflammatory prostaglandins (PGE1s), which are associated with healthy mucosal tissue and healthy tear film. The human body cannot metabolize omega-3 fatty acids to these specific anti-inflammatory prostaglandins.

Most omega-6 fatty acids are consumed in (polyunsaturated) vegetable oils as linoleic acid (LA). Excessive intake of LA is unhealthy, because it can promote inflammation if it is not properly metabolized. In contrast, omega-6 fatty acids that are *successfully* metabolized or those that have the metabolic advantage of containing gamma-linolenic acid (GLA) reduce inflammation after further metabolizing to dihomo-gamma-linolenic acid (DGLA), which also blocks, when appropriate, the pro-inflammatory arachidonic acid (AA) conversion.

The body requires all of the essential fatty acids for optimal health. They are particularly important for the patient with dry eye, because PGE1s from omega-6 are specific to mucosal tissues, including the ocular surface. The PGE1s also increase the anti-inflammatory immunosuppressive effects of cyclosporine. So, if a practitioner is set on using a cyclosporine agent to treat DED, then the use of an oral supplement will serve to enhance this action.

A good nutritional supplement should address many of the underlying inflammatory processes associated with dry eye syndrome. Oral administration of specific omega-6 essential fatty acids that contain sufficient amounts of GLA stimulate the natural production of PGE1. Black Currant Seed Oil is an excellent source of omega-6 GLA because it is more stable than either Borage Oil or Evening Primrose Oil. Many anecdotal stories abound regarding the use of Flax Seed Oil. However, it is the most unstable of the essential fatty acid oils, and it does not contain GLA. Flax LA stability issues keep it from easily converting to GLA, which it must do to produce PGE1. However, flax oil Omega-3 ALA metabolizes to Omega-3 stearidonic acid, which is also an anti-inflammatory.

Pharmaceutical grade cold-water fish oil, as a source of omega-3 EPA/DHA is germane to a good formulation. It serves as a metabolic gateway boost to the downstream conversion of the omega-3 to the anti-inflammatory PGE3, while also preventing inappropriate omega-6 arachidonic acid cleavage via the delta-5-destaurase enzyme (D5D). Vitamin E, specifically gamma tocopherols, is suggested to prevent oxidation by stabilizing the EFAs, and inhibiting COX2 enzyme activity that promotes inflammatory response.

Other Nutrients

Vitamin A is important in the health of epithelial cells, specifically those of the anterior corneal surface. It is also absolutely necessary for goblet cell and mucin production. Other co-factors necessary for optimal fatty acid metabolism include vitamin B6 and magnesium.

Curcumin appropriately blocks omega-6 and omega-3 fatty acids from metabolizing to the pro-inflammatory PGE2 and IL1. Curcumin is a natural COX2 inhibitor with similar chemical properties to ibuprofen Motrin and Advil (NSAIDS). The difference is Curcumin does not inhibit production of the COX1 enzyme that is necessary to protect the stomach lining. The first sign of an adverse response can be severe gastric bleeding.

Vitamin C, as ascorbic acid and fat-soluble ascorbyl palmitate, is suggested to best modulate PGE1 synthesis due to the extended half-life of the fat-soluble vitamin C over water-soluble ascorbic acid. This vitamin C combination is also suggested to enhance the production of IgE concentrates in tears, the first line of basophile and mast cell defense against invading pathogens and allergens that frequently cause dry eye symptoms.

Lactoferrin is suggested to increase the level of iron binding proteins to better inhibit viral and bacterial infections and to balance other tear lipocalins (family of proteins that transport small hydrophobic molecules), which modulate the surface tension of the tear film and affect the comfort of the contact lens wearer. Lactoferrin is produced in the tear film by neutrophils that constitute the first line of defense against infection. Neutrophil apoptosis signals the macrophage to clean up debris from wound sites, including surgically induced wounds (think LASIK).

These ingredients are designed to work synergistically rather than individually and effectively address the inflammatory process responsible for most dry eye syndrome, as well as enhancing and restoring function to the glands involved in all three layers of the tear film.

Treating idiopathic dysfunctional tear film with oral nutritional supplements can be an effective method to resolve this frustrating and uncomfortable condition. While it is worthwhile to uncover the cause of the condition, using the right combination of ingredients can work regardless of the causative factors.