Nutritional Therapies to Improve Surgical Outcomes

The healing process may be shorter and more effective with proper supplementation.

BY JEFFREY R. ANSHEL, OD, FAAO

All surgical interventions, including ocular procedures, alter the patient's physiology in some way. Normal physiologic processes are put on hold while the procedure is performed, but the recovery phase requires an even more robust physiologic status. This is where nutritional support in the pre- and postsurgical period can make a difference.

The two ocular areas that seem to be affected most by a patient's nutritional state are anterior (dry eyes) and posterior (macular degeneration). Below we review both areas, discuss the effects of nutrition on some of the more common surgical procedures, and explore nutritional recommendations for your patients. The point to remember is that a healthy patient coming into surgery will heal more quickly and likely more effectively after the procedure.

DRY EYE SYNDROME

We are becoming more aware of the incidence of dry eye syndrome (DES) and how it affects not only the patient's comfort but also his or her visual status. It is estimated that approximately 59 million Americans experience DES, and approximately 75% of those are over the age of 65 years.[1] DES is a condition that increases in prevalence as we age, partially due to a change in hormone balance that causes the loss of oil in the human body. Additionally, women experience the condition more often than men due to hormone receptors that inhabit the tear-producing glands.

Dry eyes can affect many surgical procedures. Consider cataract surgery, for example: A dry eye can cause inaccurate topography and keratometry readings, which can potentially throw off IOL power selection. Several studies have confirmed that a large percentage of cataract surgery patients have DES.[2,3] A typical regimen for treating dry eye preoperatively consists of topical artificial tears; unfortunately this treatment does not get to the source of the condition but rather is palliative to the patient's symptoms. In addition to artificial tears, postoperative treatment often consists of steroids, NSAIDs, and antibiotics. When patients are treated for dry eye symptoms only postoperatively, they may conclude that surgery triggered the dry eye, when quite often the source of this condition is actually blepharitis that existed before surgery.[3]

NUTRITIONAL FORMULATIONS

Oral nutritional formulations containing essential fatty acids (EFAs) are used to treat DES, some with more success than others. The effectiveness of EFAs as a treatment for DES is dependent on the proper balance of omega-6 and omega-3 (both EFAs) found in chemically stable plant oil.[4] This balance of EFAs consistently produces series 1 tear-specific antiinflammatory prostaglandin (PGE1).[5] Nutritional formulations of properly designed EFAs also block arachidonic acid (AA) fatty acid cleavage to the series 2 cyclooxygenase enzyme (COX2), which can convert to a proinflammatory series 2 prostaglandin (PGE2) without the nutrient cofactors that inhibit the formation of COX2.[6]

The effectiveness of EFA treatment of DES is also dependent on specific nutrient cofactors that aid the downstream metabolic conversion to antiinflammatory prostaglandins.[7] These nutrient cofactors stimulate the production of healthy goblet cells[8] and enhance production of clearer and thinner meibomian gland secretion. Properly designed formulations also encourage lacrimal gland secretion[9] and the production of tear lactoferrin, an antiviral, antibacterial, iron-binding protein that is particularly vital to the LASIK patient.

Dry eye nutritional formulations that are based on the

most recent science now include iron-free lactoferrin within the product. Serum lactoferrin is released from the eyelid similarly to serum immunoglobulin G, and possibly from tear neutrophils during infection and inflammation. By binding with iron, lactoferrin prevents pathogens from obtaining sufficient iron for growth.[10] Tear lactoferrin levels, now easily monitored with the second-generation Touch One Step Micro Assay System (Touch Scientific, Inc., Raleigh, North Carolina), are considered by many to be a dependable predictor of improved LASIK outcomes and a clinical marker for bacterially induced DES associated with contact lens wear.

Nutritional formulations designed around chemically stable omega-6 plant oils contain linoleic acid, significant amounts of gamma linolenic acid (GLA), and delta 6 desaturase (D6D), the nutrient cofactor necessary to ensure enzymatic conversion to the tear-specific antiinflammatory PGE1.[11] They also contain varying amounts of omega-3 alpha linoleic acid (ALA), which converts to docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA). To back up this plant-based ALA/DHA/EPA conversion, reputable formulators also include small amounts of mercury-free fish oil because it contains DHA and EPA, which are necessary to block the delta-5-desaturase (D5D) enzymatic AA cleavage of the omega-6 downstream dihomo gamma linolenic acid (DGLA) metabolite by the COX2 enzyme.[12] This enzyme, if not blocked, can convert both omega-6 DGLA and omega-3 stearidonic acid EFA to proinflammatory PGE2. Early dry eye nutritional products did not address the AA/COX2 cleavage issues as they pertain to the downstream conversion of EFA to antiinflammatory prostaglandins.

IN DEVELOPMENT

Some manufacturers are designing formulations that focus on the metabolic action of omega-3 EFA, primarily found in flax and fish oils. The omega-3 EFA also requires nutrient cofactors to consistently convert downstream to DHA and EPA, which subsequently convert to antiinflammatory series 3 prostaglandins (PGE3). PGE3 is a site-specific antiinflammatory particularly useful for rheumatoid arthritis patients. It is not as specific to tears as PGE1 from the omega-6 EFA metabolites; however, some practitioners still use flax oil as a standalone treatment for DES because it contains a large amount of omega-3 and a small amount of omega-6. Unfortunately, flax oil is highly unstable[13] and contains none of the nutrient cofactors necessary to ensure the consistent enzymatic conversion to either the antiinflammatory PGE1 or PGE3, nor does it enhance the production of tear lactoferrin.

With judicious use of advanced formula ocular lubricants and oral nutritional supplements, many patients have regained the comfort they had lost to dry eye and experience a successful surgical outcome.

MACULAR DEGENERATION

The same EFAs helpful for the anterior segment are likely to improve retinal function—an important point to remember for patients presenting with a dual diagnosis of dry eyes and dry age-related macular degeneration (AMD) of any stage. Omega-3 fats have multiple systemic health benefits:

- Cardioprotective properties: increasing high-density lipoprotein (HDL), decreasing triglycerides and apolipoprotein B (small particle low-density lipoprotein [LDL]), lowering blood pressure, and decreasing cardiac arrhythmias;
- Vasoprotective properties: raising nitric oxide endothelial production and antiplatelet properties;
- Antiinflammatory properties: protecting against cancers; and
- Neuroprotective properties: aiding in brain function and cognition.

Clearly these fats are essential to systemic health as well as retinal function and choroidal circulation. It is not surprising that fish oil benefits the eyes of dry AMD patients in virtually all studies to date, including post-hoc analysis of data from the Age-Related Eye Disease Study (AREDS).[14] Furthermore, fish oil works synergistically with two carotenoids, lutein and zeaxanthin, to thicken the protective macular pigment and quell retinal and vascular inflammation. It also has been shown to protect underlying primate retinas against damage from blue light.[15,16]

The xanthophylls lutein and zeaxanthin are underutilized functional nutrients, and clinical measurement of macular pigmentation is the subject of a recent review manuscript.[17] The concentrations of lutein and zeaxanthin in the human and primate macula are 1,500 to 10,000 times greater than their concentration in the serum, arguing for an assistive mechanism of accumulation. Mesozeaxanthin, only minimally present in the food chain, can only be converted from lutein, but it can raise macular pigment optical density (MPOD) independently when provided in supplement form.[18]

In humans, neither cone photoreceptors nor the foveal pit are fully developed at birth. Therefore, the macula undergoes major anatomic changes during early life; the cone photoreceptor outer segments are continually elongated, and cone density and packing increases from birth to 45 months.[19] Total retinal carotenoids continue to increase with age; the ratio of zeaxanthin to lutein changes, and zeaxanthin becomes dominant after approximately 2 years of age. Because most infant formulas do not

TAKE-HOME MESSAGE

- A healthy patient coming into surgery will heal more quickly and likely more effectively after the procedure.
- Oral nutritional formulations containing EFAs are used to treat DES.
- Artificial tears are palliative to the patient's symptoms and do not get to the source of the condition.

contain lutein, lutein levels increase in breastfed infants but decrease in formula-fed infants.[20]

Xanthophylls passively screen damaging blue light and actively quench reactive oxygen species, which are frequently generated in the retinal environment with the simultaneous presence of light and oxygen. Xanthophyll supplementation (lutein or zeaxanthin) consistently increases plasma concentrations; however, increases in MPOD in response to xanthophyll supplementation are variable, and the increase of xanthophyll plasma concentrations is one of the essential determinants for the xanthophylls to be transported in the retina and for MPOD augmentation. Additionally, xanthophylls contribute to AMD risk reduction and have optical absorption characteristics that contribute to improvement of visual performance in healthy people, including improving visual acuity and contrast sensitivity, reducing scotomas, and providing better glare recovery ability. We have shown this to be the case in two randomized, controlled clinical trials, the Lutein Antioxidant Supplementation Trial (LAST) and the Zeaxanthin and Visual Function Study (ZVF).[21,22] At least five other international centers have now shown improvement in visual function in AMD patients in clinical trials using xanthophyll supplementation.[23-27] The benefits of macular pigment enhancement are essential for the sensory aspects of driving, particularly driving at night or dawn.

In addition to counseling dry AMD patients on nutritional supplementation, it is helpful to tell them that light bulbs emitting light at a color temperature of 3,100 or 3,200 Kelvin are the best for aging eyes and preferable to full-spectrum lights for reading. One option is the Robin Spring 32 Desk Lamp (available from Lighthouse International through the Lighthouse Store), a 27-watt fluorescent lamp designed for glare-free or blue-free illumination. On the other hand, full spectrum light is great for establishing proper circadian rhythm in the winter, which is especially important for people with Alzheimer disease.

CONCLUSION

Many nutritional therapies are useful for improving surgical results in the anterior and posterior segments. Patients who are counseled to incorporate these supplements, such as EFAs and xanthophylls, into everyday life and who comply with this advice are likely to have better outcomes after surgery and to heal more quickly than patients who do not heed this supplementation advice. ■

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