Strategies for Optimizing the Ocular Surface Prior to Cataract Surgery

The health of the ocular surface may be an underappreciated variable in the refractive outcome.

BY CYNTHIA MATOSSIAN, MD

Advances in technology and surgical techniques have improved the ability of ophthalmic surgeons to offer predictable refractive outcomes after cataract surgery, but one aspect of the presurgical workup that may be overlooked in terms of outcomes is assessing the health and viability of the ocular surface. An unhealthy ocular surface prior to surgery can have myriad implications, such as improper measurement of the axis and magnitude of astigmatism, IOL power calculation errors, and improper or unnecessary disqualification of patients from multifocal and other advanced-technology lens options. Most profoundly, however, failure to optimize the ocular surface may negatively affect visual results and surgical outcomes.

The health of the ocular surface is of no small consideration in the cataract surgery population. Several studies highlight that the prevalence of meibomian gland dysfunction (MGD) is on the rise. This may be due to increased awareness of the problem, or other multifactorial reasons; regardless, the numbers suggest that ophthalmologists should be vigilant about identifying and treating MGD prior to surgery. According to one study, MGD is present in 37% of patients in ophthalmic practices and in 47% of patients in optometric practices, although the prevalence of some degree of MGD has been reported to be as high as 87%.[1] Another study showed that MGD is a leading cause of dry eye disease (DED), accounting for upwards of 86% of cases.[2]

IMPLICATIONS OF OCULAR HEALTH

Because as much as 75% of the refractive power of the eye occurs at the tear film interface, an unhealthy ocular surface can cause instability in refractive measurements and can lead to inconsistent sphere and cylinder readings.[3] Moreover, visual acuity becomes affected due to a rapid tear break-up time that requires forced or increased blinks to achieve visual clarity. It has become abundantly clear that an unhealthy ocular surface can undermine the accuracy of all the advanced technology that eye surgeons have access to for keratometry, topography, and wavefront imaging. As the saying goes, "garbage in, garbage out"—and an unhealthy ocular surface can certainly lead to inaccurate (garbage) measurements.

A lot depends on the accuracy of preoperative measurements. Most prominently, miscalculating the axis or magnitude of astigmatism on keratometry or topography due to instability in the ocular surface can lead to errors in the IOL calculation. This, in turn, can yield a refractive surprise after surgery and a need for additional surgical procedures—PRK, LASIK, or even an IOL exchange—to achieve the original refractive goals.

Data from a recent clinical trial elucidate this point: a multicenter clinical trial demonstrated that patients with hyperosmolarity greater than or equal to 308 mOsml had increased variability in keratometric readings.[3] In the study, 8% of hyperosmolar eyes demonstrated a 0.50 D difference in average K readings between two consecutive visits, and 17% of hyperosmolar eyes had greater than a 1.00 D difference between two visits. However, no eyes with normal osmolarity readings demonstrated differences in keratometric readings between visits. The implication of the study is that keratometric inconsistencies could cause 1 out of 10 patients to have an incorrect IOL calculation.

DIAGNOSIS, EVALUATION, TREATMENT

Diagnosing ocular surface issues, and MGD and DED in particular, is a result of a clinical evaluation and targeted diagnostic testing. In our clinic, we use a dry eye questionnaire at the time of all annual eye examinations or for visits when the chief complaint is focused on ocular surface issues. We have incorporated pertinent questions from the Ocular Surface Disease Index (OSDI) and Standard Patient Evaluation of Eye Dryness (SPEED) questionnaires into our electronic medical records system to document our patients' responses into the History of Present Illness segment of the office visit.

In addition to the dry eye questionnaire, we use Tear Osmolarity testing (TearLab) to identify irregularities in osmalrity as well as interocular variability of greater than 8 mOsml. We also use the InflammaDry (Rapid Pathogen Screening) point-of-care test, which demonstrates the existence of pro-inflammatory matrix metallopeptidase 9 biomarkers in the tear film. Additionally, we use placido disc imaging with our Nidek OPD III unit and lissamine green staining of the conjunctival and corneal surfaces.

We always share the results of these tests with patients so they

TABLE. EFFECT OF 12 WEEKS OF SUPPLEMENTATION WITH RE-ESTERIFIED OMEGA-3 FATTY ACIDS IN A CLINICAL TRIAL (N = 105)

	Baseline	6 weeks	12 weeks
Tear Osmolarity (mOsm/L)			
Placebo	326.0 + 15.4, and mOsm/L	317.0 + 20.5	317.7 + 19.7
Omega-3 group	326.2 + 15.8	309.4 + 13.4 (P = .042)	306.9 + 12.1 (P = .004)
OSDI			
Placebo	27.1 ±22.9	19.6 ±17.0	22.0 + 19.3
Omega-3 group	32.4 ±19.2	21 ±14.4 (P = .285)	15.5 + 11.0 (P = .002)
Tear Breakup Time			
Placebo	4.61 ±2.04	5.55 ±2.43	5.81 + 3.13
Omega-3 group	4.78 ±2.96	6.64 ±3.17	8.25 + 4.78

can better understand the health of their ocular surface. We have found that the better educated patients are about their ocular surface, and the more they comprehend the chronicity of MGD and DED entities, the better they adhere to the prescribed treatment regimen.

We treat the ocular surface based on the severity of the disease and use a customized, stepwise approach. Use of one or more of the following is fairly typical for most patients: omega-3 oral supplements in the re-esterfied triglyceride form, hypochlorous acid lid cleanser (Avenova; NovaBay), cyclosporine 0.05% ophthalmic emulsion (Restasis; Allergan), a microwaveable heated eye mask, intense pulsed light, or short-term topical steroids or a combination of antibiotic and steroid ointment.

NUTRITION AND THE OCULAR SURFACE

Omega-3 fatty acids, specifically eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), are the only active omega-3s useful to the body for normalizing meibum composition. These essential nutrients, which are abundant in wild marine sources (ie, fresh fatty fish), are best acquired through dietary sources.

Personal eating habits play an important role in whether enough omega-3 fatty acids are ingested on a regular basis. The average Western diet is very low in omega-3s; unless patients supplement their diets with mercury-free omega-3s in the same form as that found in fish (triglyceride form), they will be nutritionally deficient. As a consequence, their meibomian glands will not produce an optimal lipid layer—the outer most layer for the tear film—which, in turn, will lead to ocular dryness due to the rapid evaporation of the exposed aqueous layer.

Unfortunately, fresh wild fish are not easily obtained and have been shown to be high in impurities such as polychlorinated biphenyls, dioxins, and mercury. Farm-raised fish are grain fed, and therefore do not contain omega-3 fatty acids. Their value as a dietary source of omega-3s is little to none.

Because of their importance to the health of the ocular surface, and given the difficulties patients typically have in incorporating appropriate dietary sources of omega-3 fatty acids in their diets, both the Dry Eye Workshop and International Workshop on Meibomian Gland Dysfunction recommend omega-3 supplementation. The thinking behind the recommendation is that omega-3 oral supplements, used in conjunction with other dry eye treatments, will help the meibomian glands produce healthy meibum. According to research, 2 to 3 grams of EPA/DHA in a naturally occurring form (ie, re-esterfied triglyceride) and in a formulation that is free of impurities is necessary to offset the nutritional deficiency as long-term therapy.[4,5]

Other evidence is emerging that supplementation can impart a beneficial effect on the health of the ocular surface. According to a multicenter, prospective, interventional, placebo controlled, double-masked, randomized trial, oral consumption of re-esterified omega-3 fatty acids (1,680 mg EPA and 560 mg DHA once daily for 12 weeks) effectively improved osmolarity readings, OSDI scores, and tear breakup time at the end of the study (Table).[6]

CONCLUSION

The health of the ocular surface may be an underappreciated variable in the refractive outcome after cataract surgery. The presence of MGD or DED can cause visual disturbances in and of themselves, but they can also affect the accuracy of keratometric and topographic measurements; this, in turn, can yield inaccurate IOL power calculations. However, steps can be taken to identify issues and initiate treatment that can normalize the health of the ocular surface prior to surgery. Emerging evidence, as well as recommendations from leading sources of MGD and DED treatment guidelines, strongly suggest a role for re-esterified omega-3 fatty acid supplementation to offset the nutritional deficiency of essential omega-3s (EPA/DHA) needed to normalize the meibum.[7] ■

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Cynthia Matossian, MD
- founder and CEO of Matossian Eye Associates, Pennsylvania and New Jersey; clinical instructor/adjunct faculty member at Temple University School of Medicine, Philadelphia, and Robert Wood Johnson Medical School, New Brunswick, New Jersey
- cmatossian@matossianeye.com
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