THE LITERATURE

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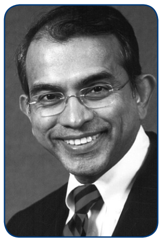

EFFECT OF TEAR OSMOLARITY ON REPEATABILITY OF KERATOMETRY FOR CATARACT SURGERY PLANNING

Epitropoulos AT, Matossian C, Berdy GJ, et al[1]

ABSTRACT SUMMARY

Epitropoulos and colleagues performed a three-center, observational, prospective, nonrandomized study evaluating the effect of tear osmolarity on the repeatability of keratometry (K) readings in patients presenting for cataract surgery.[1] A total of 75 subjects participated, of whom 50 were in the hyperosmolar group and the rest in the normal group. Entry into the hyperosmolar group entailed a tear osmolarity reading (TearLab Osmolarity System; TearLab) of greater than 316 mOsm/L in at least one eye, whereas the normal group had bilateral osmolarity readings of less than 308 mOsm/L. Two K readings were recorded within a 3-week interval using the IOLMaster (Carl Zeiss Meditec).

Variability in average K reading, calculated corneal astigmatism using vector analysis, and IOL spherical power calculations were compared between groups. The hyperosmolar group had a statistically significantly higher variability in the average K reading ($P = .05$) than the normal group and a statistically significantly higher percentage of eyes with a difference of 1.00 D or greater in the measured corneal astigmatism ($P = .02$). A statistically significantly higher percentage of eyes in the hyperosmolar group had an IOL power difference of more than 0.50 D ($P = .02$). No statistically significant differences were present when the subjects were grouped by self-reported dry eye.

The measurement of tear osmolarity when planning cataract surgery can effectively identify patients with an increased likelihood of a high unexpected refractive error resulting from inaccurate keratometry.

AT A GLANCE

- The impact of the ocular surface on patients' quality of vision continues to demand ophthalmologists' attention, especially when it comes to surgical planning and delivering the excellent quality of vision that patients have come to expect with modern cataract procedures.
- The measurement of tear osmolarity when planning cataract surgery can effectively identify patients with an increased likelihood of a high unexpected refractive error resulting from inaccurate keratometry.

DISCUSSION

The impact of the ocular surface on patients' quality of vision continues to demand ophthalmologists' attention, especially when it comes to surgical planning and delivering the excellent quality of vision that patients have come to expect with modern cataract procedures. Optimal distance and near vision without corrective glasses is highly desirable and surgically targeted when premium IOLs are used. Even with monofocal IOLs, the quality of vision after cataract surgery takes center stage.

The tear film lubricates the ocular surface and provides growth factors and nutrients to the surface epithelium.[2] Along with the corneal epithelium, the tear film provides a barrier against ocular infection and the external environment.[3] In dry eyes, an altered tear film adversely affects the ocular surface and degrades visual quality. Tear osmolarity is considered an important and significant factor in evaluating dry eye disease (DED), and tear osmolarity values should be interpreted as an indicator of DED.[4,5] Secondary effects of an increased tear osmolarity include the activation or initiation of ocular surface inflammation as well as secondary cellular alteration and damage. These and other factors play an important role in a patient's symptoms of DED. Tear osmolarity testing has become, for the most part, the key biomarker of both forms of DED—the evaporative and aqueous-deficiency states.

Tear osmolarity values of less than 308 mOsm/L are considered normal,[1,6] whereas values greater than 316 mOsm/L are considered hyperosmolar.[1,6] With the TearLab Osmolarity System, readings to a cutoff of 308 mOsm/L have generally been held to represent mild forms of DED, and a cutoff of 316 mOsm/L has signified more moderate/

> "Instability in the tear film that bathes the ocular surface ... affects the K readings used in IOL calculations."

severe DED states.[1,6] Versura et al reported 305 mOsm/L as the cutoff value for DED and values of 309 mOsm/L and 318 mOsm/L as representing moderate and severe DED, respectively.[4]

Although normal tear film osmolarity levels along with other factors help maintain a normal tear homeostasis, elevated osmolarity values are a reliable indicator of DED.[5] Both eyes are measured independently, because a variability in osmolarity elevation between the two eyes increases with severity of disease and does not occur in healthy eyes.[5,6] Whereas healthy eyes have low and stable osmolarity, those with DED have raised and more variable osmolarity readings. Furthermore, the intereye variability in tear osmolarity readings is 6.9 ±5.9 mOsm/L in normal subjects[7] versus greater than 8.0 mOsm/L in DED patients.[5,7]

The cause of DED has long been considered to be any disorder that increases tear evaporation or decreases tear secretion.[8] Both evaporative and aqueous-deficient DED negatively affect the corneal and ocular surface, and one or both states may coexist in the same individual. The severity of DED correlates with tear osmolarity measurements and could therefore provide a biomarker for disease severity.[9] Increased tear osmolarity in DED plays an etiological role among other factors in desquamation, alteration, and destabilization of the ocular surface.[10] The attrition or loss of goblet cells compromises overall mucin expression onto the ocular surface, which contributes to secondary instability in the tear film that bathes the ocular surface. Such alteration affects the K readings used in IOL calculations for cataract surgery.

Epitropoulos and colleagues used the IOLMaster to measure keratometry in this study. This device measures six points about 2.5 mm from the central anterior cornea.[1,11,12] The measurements are based on partial coherence interferometry. In DED with an altered tear film, the reduced quality of corneal reflections on the corneal surface can compromise K readings.[13] In the hyperosmolar group, significantly more variability in the average K readings and anterior corneal astigmatism resulted in significant differences in the IOL power calculations. Such alterations in the measured IOL power will translate into a poorer visual quality and outcomes after cataract surgery as well as patients' dissatisfaction, especially among those receiving premium IOLs. Hence, the investigators recommended tear osmolarity measurement to identify patients whose DED might compromise the results of cataract surgery. Two publications advanced ophthalmologists' understanding of DED and shed light on the central role of tear osmolarity and inflammation in DED and their impact on the ocular surface: the Delphi panel report in 2006[14] and the International Workshop on Dry Eye report in 2007.[15]

Epitropoulos and colleagues used tear osmolarity measurement to identify DED patients before cataract surgery and to provide objective, useful clinical data, especially in the hyperosmolar group. Other methods of detecting DED prior to cataract surgery should also be employed, including patients' ocular symptoms of DED; tear meniscus height; corneal and conjunctival punctate staining using lissamine green, fluorescein, or rose bengal; tear breakup time; Schirmer testing; corneal topography; and other clinical tests. Patients should then receive aggressive treatment to improve the health of the ocular surface, control inflammation, and promote a more stable tear film, all of which will improve the corneal surface reflections, the reliability of preoperative K readings, and the accuracy of IOL power calculations. The result will be better visual outcomes and happier patients. ■

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