Commentary: Effect of dry eyes on the corneal diagnostic measurements

Many of us may have seen That "one" topography scan that seemed like that of keratoconus but turned out to be regular cornea after instilling a drop of lubricant in the eyes. Many of us would have also ordered for a tomograph to be repeated for a patient in the clinic and then wondered as to how two scans done ten minutes apart come out to be significantly different![1] Probably the common link between these two scenarios is dry eyes or to be more precise, "the distorted tear optics" due to dryness in the eyes!

It is important to understand the impact that the tear film has on cornea diagnostic measurements, which include keratometry, corneal topography, and wavefront analysis. These measurements are based on light projections and reflections off or through the tear film. Keratometers rely on reflections from 2 to 24 points within a 3.2-mm diameter on the central cornea to estimate the corneal curvature. These data points increase to thousands of points when measured with corneal topographers within larger 3, 5, 7 mm zones to estimate corneal curvature. Wavefront aberrometers project light onto the pre-corneal tear film through to the retina to detect aberrations along its path.

Way back in 1999, Liu *et al*.[2] reported that the surface regularity index (SRI) and surface asymmetry index (SAI) were significantly elevated and the potential visual acuity (PVA) index was significantly reduced in dry eye patients compared with normal subjects as measured by TMS-1, a corneal topography instrument. Huang *et al*.[3] in their study reported that tear film changes in dry eye patients, especially in those with punctate epithelial epitheliopathy, may lead to irregularities on the corneal surfaces, causing glare disability. These changes may be too subtle in the early stages of dry eyes to be detected by corneal topography or contrast sensitivity measurements. However, significant improvement in SRI, SAI, PVA, and contrast sensitivity were found after instillation of artificial tears in dry eyes with punctate epithelial keratopathy.

Kundu *et al*.[4] in their article titled "Impact of tear optics on the repeatability of Pentacam AXL wave and iTrace in measuring anterior segment parameters and aberrations" have done well to elaborate on this concern. I agree with the authors that as tear film is the first refractive medium that is encountered by the light entering the eye, it is quite intuitive to hypothesize that any abnormality in the tear film is likely to cause distortion of the light wave which would affect the outcome that the diagnostic instrument is trying to measure. What is to be studied and learned in more detail is the quantum of this variation that would

be encountered by a diagnostic instrument which is likely to be directly related to the severity of the dry eyes in a subject.

A particular cause of concern for researches has been to establish how the severity of dry eyes would affect the calculation of intraocular lens (IOL) power for cataract patients who have coexisting dry eye disease. This concern has been raised by many researchers in the past with variable conclusions. Epitropoulos *et al*.[5] in their study noted that significantly more variability in average K and anterior corneal astigmatism was observed in the hyperosmolar group, with significant resultant differences in IOL power calculations. Hong Lianhua *et al*.[6] in their study noted that dry eye affects the accuracy of the determination of IOL power. They further stated that compared with the preoperative refraction predictive value, the postoperative refraction shifts towards hyperopia with deviation of about 0.5–0.75D.

As we understand that air–tear interface is the first refracting surface encountered by light from the instruments, it is imperative that a smooth pre-corneal tear film will yield more reliable and repeatable measurements than an irregular and highly dynamic tear film, such as in dry eye patients. Going forward, we need to look into this aspect that may play a significant role in the repeatability of cornea diagnostic measurements by various instruments.

Mukesh Taneja

Cornea, Cataract and Refractive Services,
Tetravue Superspeciality Eye Centre, Delhi, India

Correspondence to: Dr. Mukesh Taneja,
Tetravue Superspeciality Eye Centre, F-102, Bali Nagar, Delhi, India.
E-mail: mukeshtaneja@yahoo.co.in

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