IMPROVING OPTICAL QUALITY WITH ARTIFICIAL TEARS

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Dryness of the ocular surface affects the optical quality of the eye. There is considerable evidence that local changes in tear-film thickness and regularity introduce additional optical aberrations in the eye.[1] Dry eye syndrome refers to a spectrum of ocular diseases with diverse etiologies.[2] The common feature of these ocular diseases is an abnormal tear film. Dry eyes show an irregular tear-film distribution across the corneal surface compared with normal eyes. The time course of dynamic aberration changes observed during normal blinking is accelerated in dry eye patients with abnormal tear films.[3,4]

The primary treatment goals for dry eye are to relieve discomfort, provide a smooth optical surface, and prevent corneal damage. Frequent instillation of drops that do not present a risk of toxicity or allergy is the most successful form of therapy. Artificial tears that imitate human tears are currently available. The goals of therapy with these tears are to provide moisture, surface wetting, comfort, and retention of the solution for as long as possible. Meeting these goals should improve tear break-up time (TBUT) values and the optical quality of the air–tear-film interface.

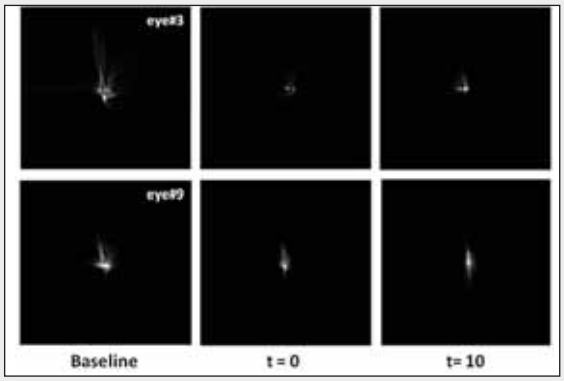

Figure 1. Retinal PSFs for two eyes corresponding to a 5.5-mm pupil size. The poor optical quality at baseline and its improvement after eye drops is seen.

An irregular tear film compromises optical quality in patients with dry eye syndrome. After eye-drop instillation, a reduction in optical aberrations associated with an increasingly regular tear film should be expected. Studies evaluating the effect of

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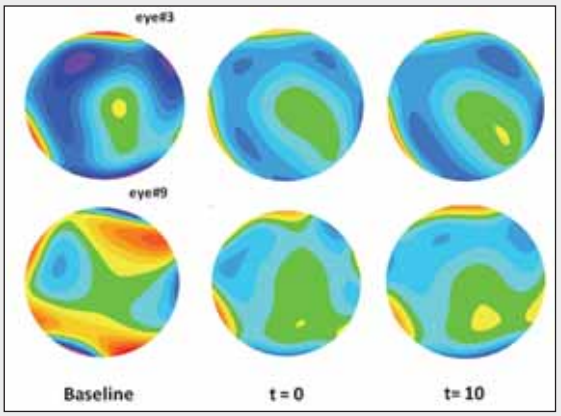

Figure 2. Air–tear-film interface wavefront aberration contour plots at baseline, immediately after, and 10 minutes after eye drop instillation for the same two eyes as in Figure 1. The contour line step is 1 µm. Only higher-order aberrations (third to sixth) are shown.

eye drops on Hartmann-Shack wavefront aberrometry concluded that eye drops improved optical quality in both dry[5,6] and healthy eyes.[2] Because changes occur in the air–tear-film interface after eye drops are administered, wavefront analysis should focus on corneal aberrations after blinking[7] to properly investigate the effect of blinking on healthy[8] and dry eyes.[3,4]

In a nonrandomized masked observational case series (self-controlled), wavefront aberrations of the air–tear-film interface were measured in 40 eyes with dry eye before and after the instillation of Blink Intensive Tears (Abbot Medical Optics Inc., Santa Ana, California) on 3 separate days.[9]

This artificial tear is composed mainly of polyethylene glycol 400 (0.25%), sodium hyaluronate as a viscosity enhancer, and the preservative OcuPure (stabilized oxuchloro complex 0.005%; Abbott Medical Optics Inc.). In all cases, measurements were carried out before instillation (baseline), immediately after instillation (T0), and 10 minutes after instillation (T10). At baseline, mean TBUT was 3.6 ±1.7 seconds. Eye-drop instillation lengthened TBUT values to 5.8 ±1.4 seconds at T0 and 4.9 ±1.3 seconds at T10 (P <.01).

The point spread function (PSF) of the air–tear-film interface improved considerably after instillation, obtaining the best contrast and minimal size of the PSF immediately after eye drops were administered (Figure 1). Higher-order aberrations (HOAs) and spherical-like and coma-like aberrations were significantly reduced by a factor of 2.5 at T0 (Figure 2). In all cases and for all pupil sizes measured, the reduction of HOAs (P =.008), spherical-like aberrations (P =.006) and coma-like aberrations (P =.007) was statistically significant at the 1% level. At T10, HOAs (P =.09), spherical-like aberrations (P =.007), and coma-like aberrations (P =.007) were still statistically significantly lower than at baseline.

Eye drops can have a significant impact on ocular aberrations of the eye.[2,4] Montés-Micó et al,[5] using a Hartmann-Shack wavefront aberrometer to measure ocular aberrations, reported a reduction in optical aberrations after eye drop instillation in dry eyes. These findings agreed with other results recently reported that analyzed only the air–tear film interface, showing a considerable reduction for small and large pupil diameters.

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