alternations in tear cycle and the static image taken may not represent tear film states between blinks, it is also important to have the ability to monitor dynamic changes of the tear film. Moreover, it is critical to observe the natural status of tear film and detect its changes without causing the disturbance to the tear film. Previous reports have limitations in the results due to the fact that forced repeated blinking, topical anesthesia[8,9,10] or an artificial eye drop was used. To this end, we will have developed new methods to overcome these limitations by means of non-invasive, simultaneous and sequential measurements of the tear film.

With the exponential increase of computer usage in the office, dry eye related to visual terminal (VDT) use has been a major health problem.[11] In a clinical population, there are numerous borderline cases that fall between evaporative dry eyes and normal eyes, in which tear film instability and dry eye symptoms are found without ocular surface damage and tear deficiency. Even in clinically normal subjects, those “at risk of developing dry eye” were identified with unstable variations in sequential post blink changes in optical quality of the eye.[9] Because tear film instability may predispose to dry eye in response to ocular surface stress in borderline cases of evaporative dry eye or in “at risk developing dry eye” cases, it is extremely important to have more reliable and objective criteria for early diagnosis of dry eye and perhaps more importantly for adequate treatment choice among numerous options. Therefore, we strive to understand quality and thickness of the tear film and its optical properties as it changes dynamically in normal individuals and in those with dry eye symptoms in normal and adverse environmental shows an example of a tear film break pattern measured with the wavefront-sensor. This sensor is currently modified to have a higher resolution for both clinical studies and further scientific development of dry eye research.

Optical coherence tomography (OCT)[14,15]: OCT is a non-invasive, high-resolution imaging technique based on low-coherence interferometry and provides cross-sectional images of biological tissues. Its principle is the same as ultrasound imaging with only one difference. OCT uses light waves instead of sound waves. Light waves are sent into the sample and the time delay is measured using interference of the sample and reference beams. OCT can provide high resolution images (2-10µm) depending on center wavelength and bandwidth of light source. We use OCT to image the anterior segment of the eye especially around tear boundaries. Figure 3 shows a cross sectional image including cornea and both lower and upper tear menisci capture with our OCT with a 10µm axial resolution. We upgraded the current OCT to have a 1µm resolution so that tear thickness (several microns) over the cornea can be imaged.

Ellipsometer

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