

Visualization of invisible findings on meibomian glands using non-invasive meibography and tear interferometry

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Meibomian gland secretes lipids (meibum) into the tear film and prevent excessive evaporation from the tearfilm. We developed “Non-invasive Meibography”, which enables us to observe meibomian gland without any invasive manner and discomfort sensation. Based on the obtained images of meibomian glands, the lost area of the meibomian gland was semi-quantitatively evaluated as meiboscore. Partial or complete loss of meibomian glands was scored for each eyelids from grade 0 to grade 3. Since we established the observation method of meibomian gland and the evaluation method, we investigated the alternation of the meibomian gland by aging, meibomian gland dysfunction, aqueous deficient dry eye, contact lens wear, allergic conjunctivitis or anti-glaucomatous eye drops use. Especially, we found that the decreased temperature of tarsal conjunctiva in patients with meibomian gland dysfunction was detected, where the area was coincided to the lesion of lost area of meibomian glands by meibography. In addition to the semi-quantitative evaluation for meibomian gland, we developed the automatic quantification program of meibomian gland area. This method enabled us to evaluate the efficacy of the treatment for meibomian gland dysfunction.

Tear interferometry has been applied as a noninvasive method for visualization of the lucent lipid layer at the surface of the tear film. Tear interference images associated with surface phenomena of the tear film have thus been obtained based on a principle first described by Newton. This approach has been adopted to study tear dynamics in individuals with Sjögren syndrome or dry eye, including MGD, as well as in contact lens wearers. Tear interferometry thus provides information on both the quality and quantity of the lipid layer, yielding insight into the function of the entire tear film. We investigated whether the tear interferometric pattern was able to identify differences in tear film kinetics among clinical subtypes of dry eye. Our results indicate that the interferometric color and fringe patterns associated with tear film stability reflect the balance between the aqueous and lipid layers of the tear film, and they suggest that these patterns are able to identify subtypes of dry eye.

In this talk, I am going to review the series of investigations in non-invasive meibography, and present the latest studies regarding the function of meibomian gland dysfunction using tear interferometry.