Identification of dry eye subtypes by tear interferometry

Reiko Arita[1,7] Naoyuki Morishige,[2,7] Tatsuya Fujii,[3,7] Shima Fukuoka, [4,7] Jae Lim Chung,[5] Kyoung Yul Seo,[6] Yasuko Fukuda,[1] Kouzo Itoh[1]

[1]Itoh Clinic, Saitama, Japan; [2]Department of Ophthalmology, Yamaguchi University Graduate School of Medicine, Ube, Yamaguchi, Japan; [3]Kowa Pharmaceutical Co. Ltd., Tokyo, Japan; [4]Omiya Hamada Ophthalmic Clinic, Saitama, Japan [5]Kim's Eye Hospital, Konyang University, Seoul, South Korea; [6]Department of Ophthalmology, Yonsei University College of Medicine, Seoul, South Korea; [7]Lid and Meibomian Gland Working Group (LIME), Japan

Purpose: Tear interferometry allows qualitative and quantitative evaluation of the lipid layer of the tear film. We investigated whether the pattern of tear film kinetics revealed by tear interferometry is able to identify clinical subtypes of dry eye.
Methods: A total of 211 eyes of 211 patients (mean age ± SD, 65.1 ± 13.7 years) who visited Itoh Clinic from May to August 2015 were enrolled. Clinical diagnosis of dry eye subtype was based on tear film parameters (ocular surface staining, fluorescein tear film breakup time) and lid margin abnormalities as revealed by slit-lamp microscopy, morphological changes of meibomian glands identified by noninvasive meibography, and Schirmer test value. The pattern of tear film kinetics determined with a tear interferometer (DR-1α, Kowa) was classified as: (1) normal (gray monotonous color interferometric fringe and/or multicolor interferometric fringe with a noninvasive breakup time [NIBUT] of ≥5 s); (2) colored fringe (multicolor interferometric fringe with a NIBUT of <5 s}); or (3) amorphous fringe (amorphous grayish interferometric fringe with a NIBUT of <5 s). The agreement between clinical diagnosis—normal tear condition, aqueous-deficient dry eye (ADDE), or evaporative dry eye (EDE)—and interferometric pattern, as well as the levels of interrater and intra-rater agreement for each pattern, were evaluated with kappa statistics. The relation between the multicolor interferometric fringe and lipid layer thickness (LLT) was also investigated.
Results: The kappa value for overall agreement between the normal tear condition and the normal interferometric pattern, between ADDE and the colored fringe pattern, and between EDE and the amorphous fringe pattern was 0.86. The inter-rater kappa values for evaluation of interferometric patterns ranged from 0.61 to 0.90 for both ophthalmologists and non-ophthalmologists with reference to a dry eye expert (R.A.),

the latter of whom showed an intra-rater reliability of 0.90. A multicolor interferometric fringe was observed at an LLT of >70 nm.
Conclusions: Tear interferometry was able to reliably distinguish the normal tear condition, ADDE, and EDE. Interferometric pattern classification was reliably performed by not only dry eye experts but also general ophthalmologists and even non-physicians. Tear interferometry therefore evaluate the balance of lipid layer and aqueous layer in tear film, contributing to the clinical diagnosis of dry eye.