## Increased tear fluid production as a compensatory response to meibomian gland loss: a multicenter cross-sectional study

Reiko Arita,<sup>1,2,3,4</sup>\* MD, PhD, Naoyuki Morishige,<sup>1,5</sup>\* MD, PhD, Shizuka Koh,<sup>1,6</sup> MD, PhD, Rika Shirakawa,<sup>1,3</sup> MD, Motoko Kawashima,<sup>1,4</sup> MD, PhD, Tohru Sakimoto,<sup>1,7</sup> MD, PhD, Takashi Suzuki,<sup>1,8</sup> MD, PhD, and Kazuo Tsubota<sup>4</sup> MD, PhD

 <sup>1</sup>Lid and Meibomian Gland Working Group, Japan
<sup>2</sup>Department of Ophthalmology, Itoh Clinic, Saitama, Japan
<sup>3</sup>Department of Ophthalmology, The University of Tokyo, Tokyo, Japan
<sup>4</sup>Department of Ophthalmology, Keio University School of Medicine, Tokyo, Japan
<sup>5</sup>Department of Ophthalmology, Yamaguchi University Graduate School of Medicine, Yamaguchi, Japan
<sup>6</sup>Department of Ophthalmology, Osaka University Graduate School of Medicine, Osaka, Japan

<sup>7</sup>Department of Ophthalmology, Nihon University School of Medicine, Tokyo, Japan <sup>8</sup>Department of Ophthalmology, Ehime University Graduate School of Medicine, Ehime, Japan

\*These authors contributed equally to this work.

Corresponding author: Reiko Arita, MD, PhD, Department of Ophthalmology, Itoh Clinic, 626-11 Minami-Nakano, Minuma, Saitama, Saitama 337-0042, Japan. E-mail: ritoh@za2.so-net.ne.jp

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Running head: Homeostasis of the tear film

## Abstract

**Purpose:** To compare tear film parameters as well as meibomian gland morphology and function among patients with meibomian gland dysfunction (MGD), those with non–Sjögren syndrome aqueous-deficient dry eye (non-SS ADDE), those with non-SS ADDE and MGD, and normal subjects.

Design: Multicenter cross-sectional observation case series.

**Participants:** Forty-one eyes of 41 patients (all women; mean age  $\pm$  SD, 62.1  $\pm$  9.9 years) with non-SS ADDE, 70 eyes of 70 patients (all women; 66.0  $\pm$  8.7 years) with MGD, 17 eyes of 17 patients (all women; 72.4  $\pm$  7.8 years) with non-SS ADDE/MGD, and 70 eyes of 70 normal control subjects (all women; 65.0  $\pm$  7.1 years).

**Methods:** Ocular symptoms were scored from 0 to 14 and lid margin abnormalities from 0 to 4 according to their respective number. Meibomian gland changes were scored from 0 to 6 (meiboscore) on the basis of noncontact meibography findings, and meibum was graded from 0 to 3 depending on its volume and quality. Conjunctival and corneal epithelial damage was scored from 0 to 9 (fluorescein score). Breakup time (BUT) was measured as an index of tear film stability, and tear fluid production was evaluated with Schirmer's test.

Main Outcome Measures: Ocular symptom score, lid margin abnormality score,

meiboscore, meibum grade, fluorescein score, BUT, and Schirmer's test value.

**Results:** The ocular symptom score did not differ significantly between the MGD and non-SS ADDE groups (P = 0.762). The lid margin abnormality score, meiboscore, and meibum grade were significantly higher in the MGD group than in the non-SS ADDE group (P = 0.0012, P < 0.0001, and P < 0.0001, respectively). The fluorescein score, BUT, and Schirmer's test value were significantly worse in the non-SS ADDE group than in the MGD group (P < 0.0001, P = 0.0061, and P < 0.0001, respectively). The meiboscore correlated significantly with Schirmer's test value only in the MGD group (rho = 0.508,  $P = 8.3 \times 10^{-6}$ ).

**Conclusions**: An increase in tear fluid production likely serves to compensate for loss of meibomian glands in individuals with MGD.