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LETTER

Objective Evaluation of Relationship Between Tear Film Stability and Visual Fatigue [Letter]

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Dear editor

We read with keen interest the article titled "Objective Evaluation of Relationship Between Tear Film Stability and Visual Fatigue" by Watanabe et al.[1] The authors investigate the association between non-invasive tear film break-up time (NIBUT) and binocular fusion maintenance (BFM) as indicators of visual fatigue a commendable effort, given the increasing clinical burden of digital eye strain (DES) in today's screen-dominant lifestyle. However, we wish to highlight certain methodological limitations and areas for improvement that would enhance the study's clinical relevance and scientific rigor.

A key concern is the study's small sample size (n = 11) and restricted demographic (young, healthy adults). Dry eye disease and visual fatigue affect a wider population, including older individuals, people with refractive errors, and those with binocular vision disorders.[2] The homogeneity of the sample limits the generalizability of the results. Future studies would benefit from including a more diverse cohort to better represent the population experiencing digital fatigue.

The 30-minute screen task used in this study, although aligned with prior protocols, may not fully capture the temporal dynamics of ocular surface changes. Research suggests that visual discomfort and tear film instability tend to intensify with prolonged screen exposure, often beyond 30 minutes.[3] Additionally, compensatory mechanisms such as altered blink behavior or ocular surface exposure emerge more prominently with longer tasks. Including extended screen durations in future research would improve ecological validity. Another limitation is the exclusive reliance on NIBUT as an objective tear film parameter. Although NIBUT provides quantitative insight, the test requires patients to suppress blinking, which is inconsistent with natural screen use. Moreover, blink rate and blink completeness critical factors in tear film stability were not assessed. These parameters have been shown to significantly influence ocular comfort and tear dynamics during screen tasks.[4] Incorporating eye-tracking or blink-monitoring tools would provide a more comprehensive evaluation of the ocular surface environment under screen stress.

We also noted the absence of subjective symptom assessment tools, such as the Ocular Surface Disease Index (OSDI) or the Computer Vision Syndrome Questionnaire (CVS-Q). While the study aims to reduce reliance on subjective reporting, visual fatigue remains a subjective experience that is often not fully captured through objective testing alone. Validated questionnaires would allow correlation between measurable tear film changes and perceived discomfort, thereby enhancing clinical applicability.[5] The correlation between NI-BUT and BFM ($R^2 = 0.385$) is statistically significant, the modest effect size indicates the potential involvement of additional variables such as accommodative and vergence anomalies, both known contributors to DES. Evaluating parameters like accommodative amplitude, vergence ranges, and fixation disparity would help interpret the observed changes in binocular function more accurately.

In conclusion, Watanabe et al present an important preliminary study linking tear film instability with visual fatigue. To advance the field, future studies should include larger, more heterogeneous populations, longer task durations, blink analysis, and validated symptom questionnaires, while considering the broader visual system.

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Disclosure

The authors report no conflicts of interest in this communication.

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