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TEAR FILM DYSFUNCTION AND MEIBOMIAN GLAND DROPOUT IN CHRONIC SMARTPHONE USERS: A CROSS-SECTIONAL STUDY

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ABSTRACT **Purpose:** To evaluate tear film function and meibomian gland morphology in chronic smartphone users and compare them with individuals having minimal screen exposure. **Methods:** A hospital-based cross-sectional study was conducted at Nagri Eye Hospital from December 2023 to August 2024. Eighty participants aged 18–40 years were enrolled and divided into two groups: Group A (chronic smartphone users; usage >6 hours/day for at least 6 months) and Group B (controls; usage <1 hour/day). OSDI questionnaire, Schirmer I test, TBUT, and infrared meibography were performed. Data were analyzed using SPSS v26.0, with $p < 0.05$ considered statistically significant. **Results:** Mean OSDI score was significantly higher in chronic users (32.4 ± 7.1) compared to controls (14.7 ± 5.9). Mean TBUT was 7.3 ± 2.1 seconds in users versus 11.6 ± 2.5 in controls ($p < 0.001$). Schirmer I values were 12.8 ± 3.2 mm vs. 18.4 ± 2.9 mm respectively. Meibography revealed partial or diffuse meibomian gland dropout in 68% of chronic users vs. 20% of controls ($p < 0.001$). Screen time correlated negatively with TBUT ($r = –0.56$, $p < 0.001$). **Conclusion:** Chronic smartphone use is significantly associated with reduced tear film stability and increased meibomian gland dropout, highlighting the need for preventive ocular care in heavy screen users.

KEYWORDS :

INTRODUCTION

The proliferation of smartphones has changed modern lifestyles, increasing average screen time dramatically. Prolonged digital device use is associated with ocular discomfort and dryness due to reduced blink rate, incomplete blinks, and increased tear evaporation. Structural changes in the meibomian glands have been reported in habitual screen users, contributing to evaporative dry eye. This study aims to evaluate tear film parameters and meibomian gland dropout in chronic smartphone users compared with individuals having minimal digital exposure.

MATERIALS AND METHODS

This cross-sectional study was conducted at Nagri Eye Hospital between December 2023 and August 2024 after institutional ethics committee approval. Eighty participants (18–40 years) were divided into Group A (chronic smartphone users: >6 hours/day for ≥6 months) and Group B (controls: <1 hour/day). Exclusion criteria included ocular surgery, trauma, diabetes, thyroid disease, and contact lens use.

All participants underwent detailed ophthalmic evaluation including OSDI questionnaire, Schirmer I test, TBUT, and non-contact meibography using infrared imaging. Meibomian gland dropout was graded as per Arita's classification. Data were analyzed using SPSS v26.0; $p < 0.05$ was considered significant.

RESULTS

The mean age was 27.6 ± 5.8 years. The OSDI score, TBUT, Schirmer I values, and meibomian gland dropout differed significantly between groups ($p < 0.001$). Duration of screen exposure correlated negatively with TBUT and Schirmer values, and positively with OSDI scores.

Parameter	Smartphone Users	Controls	p-value
OSDI Score	32.4 ± 7.1	14.7 ± 5.9	<0.001
TBUT (sec)	7.3 ± 2.1	11.6 ± 2.5	<0.001
Schirmer I (mm)	12.8 ± 3.2	18.4 ± 2.9	<0.001
MG Dropout (%)	68%	20%	<0.001

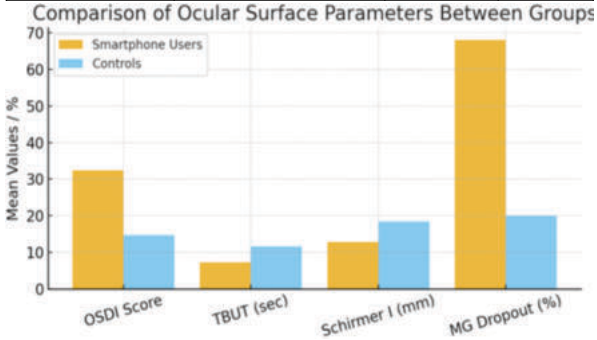

Figure 1: Comparison of mean ocular surface parameters between chronic smartphone users and controls.

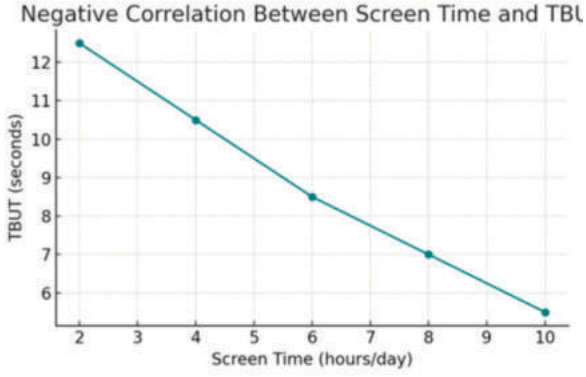

Figure 2: Negative correlation between screen time and TBUT showing decreased tear film stability with increased screen exposure.

DISCUSSION

Chronic smartphone use was found to be associated with significantly higher OSDI scores and reduced tear film stability. These findings are consistent with previous studies by Moon et al. and Arita et al., which demonstrated meibomian gland dropout and dry eye symptoms among habitual digital device users. Reduced blink rate and increased ocular surface exposure during near work are key contributors. Early screening and visual hygiene education are recommended to reduce the impact of digital eye strain.

CONCLUSION

Prolonged smartphone use (>6 hours/day) is significantly associated with tear film instability, decreased aqueous secretion, and meibomian gland dropout. Chronic exposure to digital screens poses a potential risk for early-onset evaporative dry eye disease in young adults.

Public education on visual hygiene, regular blinking exercises, screen breaks, and early ophthalmic screening are essential preventive strategies to mitigate the ocular impact of digital lifestyles.

Conflict Of Interest

None declared.

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