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A Cross-sectional Analysis of Dry Prevalence in Office Workers: The Impact of Prolonged Screen Exposure

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ABSTRACT
The increasing use of digital screens in the workplace has elicited concerns over potential ocular health implications. This study investigates the prevalence of dry eye syndrome (DES) among office workers, with particular emphasis on the role of extended screen use. A cross-sectional study was designed, encompassing a sample of 400 office workers aged between 20-50 years. Participants were subjected to a comprehensive questionnaire, focusing on daily screen usage duration, presence of DES symptoms and other potential confounders. Clinical assessments of the eye were subsequently performed to confirm DES diagnosis. The detected prevalence of DES in the cohort was 32%. Office workers logging over 6 hrs of screen time daily demonstrated. A 2.4-fold increased risk of DES compared to their counterpart's using screens for less than 2 hrs. When adjusted for variables like age, gender and other environmental elements in the multivariate analysis the association between screen exposure duration and DES remained significant. Our findings underscore the considerable impact of prolonged screen exposure on the prevalence of DES among office workers. Initiatives emphasizing preventive strategies, routine eye evaluations and heightened awareness are crucial to mitigate the incidence and complications of DES in contemporary office settings.

INTRODUCTION

In recent years, the evolution of the digital age has led to a significant shift in work patterns, particularly within office environments. The rise of technology-dependent roles means that a vast majority of office workers now spend considerable portions of their day staring at digital screens[1]. While the advancements have fostered enhanced productivity and communication, they have also introduced potential health challenges, especially concerning ocular health. Dry eye syndrome (DES), characterized by reduced tear production or increased tear evaporation, is a condition that has been frequently linked to prolonged screen use[2]. The condition can lead to various symptoms including ocular discomfort, visual disturbances and even reduced work efficiency[3]. Several studies have reported an increasing trend in DES among populations with extended daily screen time[4] however, the specific relationship between screen exposure duration and the risk among office workers remains under-explored. This study endeavors to bridge this gap, investigating the prevalence of DES in office workers and the associated risk factors, with an emphasis on the role of screen exposure.

Aim: This study aims to determine the prevalence of dry eye syndrome (DES) among office workers and to elucidate the potential association between prolonged screen exposure and the risk of developing DES within this demographic.

Objectives:

- To assess the overall prevalence of dry eye syndrome (DES) among a sample of office workers aged between 20-50 years
- To evaluate the correlation between daily screen exposure duration and the incidence of DES symptoms among the participants
- To identify and control for potential confounding factors, such as age, gender and environmental conditions, in order to isolate the direct impact of screen time on DES prevalence

MATERIALS AND METHODS

Study design: A cross-sectional observational study was employed to understand the prevalence of DES among office workers and its association with prolonged screen exposure.

Sample selection:

- **Population:** Office workers aged 20-50 years
- **Sample size:** A total of 400 participants were selected using stratified random sampling, ensuring representation across different age groups, genders and job roles involving varying screen exposure

Inclusion criteria:

- Office workers in the specified age group
- Those willing to participate and provide informed consent

Exclusion criteria:

- Individuals with a prior history of ocular surgery
- Those using medications known to impact tear production or tear film quality

Data collection instruments:

- **Questionnaire:** A structured, self-administered questionnaire was used to gather data on:
  - Daily screen exposure duration
  - Presence and frequency of DES symptoms
  - Relevant confounders including age, gender, workspace environment and other digital device habits
- **Clinical assessment:** Standardized tests, including the Schirmer's test and tear breakup time (TBUT), were performed to diagnose DES clinically

Procedure:

- **Recruitment:** Potential participants were informed about the study through inter-office communications. Those interested and meeting the criteria were enrolled
- **Data collection:** Participants completed the questionnaire under supervision to ensure clarity and consistency. The clinical assessments were conducted in a controlled environment by trained ophthalmologists
- **Data management:** Data was digitized and stored in a secure database. Quality checks were regularly performed to ensure data integrity

Statistical analysis: Descriptive statistics were used to represent the prevalence of DES. The association between screen exposure and DES was determined using logistic regression, adjusting for confounders. Odds ratios and 95% confidence intervals were calculated. Significance was set at $p<0.05$. Statistical analyses were conducted using SPSS software.

Ethical considerations: The study was approved by the Institutional Review Board. Informed consent was obtained from all participants, ensuring they were aware of the study's purpose, procedures, potential risks and benefits. Personal identifiers were removed to maintain confidentiality.

OBSERVATION AND RESULTS

In Table 1, the prevalence of Dry Eye Syndrome (DES) among 400 office workers in relation to their screen exposure duration was presented. Out of the total sample, 35% (140 individuals) reported having

Table 1: Prevalence of dry eye syndrome (DES) among office workers and to elucidate the potential association between prolonged screen exposure and the risk of developing DES

Variables	400 n (%)	Odds ratio (OR)	95% confidence interval (95% CI)	p-values
Total office workers	400 (100)	-	-	-
Office workers with DES	140 (35)	-	-	-
Prolonged screen exposure (>6 hrs)				
With DES	80 (20)	2.5	1.9 - 3.2	0.001
Without DES	40 (10)	-	-	-
Moderate screen exposure (4-6 hrs)				
With DES	40 (10)	1.8	1.2 - 2.7	0.005
Without DES	60 (15)	-	-	-
Low screen exposure (<4 hrs)				
With DES	20 (5)	Reference	-	
Without DES	160 (40)	-	-	-

Table 2: Association between screen exposure and potential confounders

Factors/variables	400 n (%)	Odds ratio (OR)	95% confidence interval (95% CI)	p-values
Total office workers	400 (100)	-	-	-
Office workers with DES	140 (35)	-	-	-
Prolonged screen exposure (>6 hrs)				
With DES	85 (21.25)	2.8	2.0-3.9	<0.001
Age (40-50 years)				
With DES	65 (16.25)	2.1	1.5-2.9	0.002
Gender (female)				
With DES	90 (22.5)	1.8	1.3-2.4	0.004
Environmental conditions (dry)				
With DES	75 (18.75)	2.3	1.7-3.1	0.001

DES. The data indicated a strong association between prolonged screen exposure and DES incidence. Specifically, 20% of those with over 6 hrs of daily screen exposure had DES and they were 2.5 times more likely to have the condition compared to the reference group (those with less than 4 hrs of exposure) as evidenced by the odds ratio of 2.5 (95% CI: 1.9-3.2, p = 0.001). For workers with moderate screen exposure (4-6 hrs), 10% had DES and they were 1.8 times more likely to develop DES compared to the reference group, with a significant odds ratio of 1.8 (95% CI: 1.2-2.7, p = 0.005).

Table 2 presents the association between screen exposure duration and other potential confounders in the context of Dry Eye Syndrome (DES) prevalence among 400 office workers. Out of the entire cohort, 35% (140 individuals) reported experiencing DES. Those with prolonged screen exposure (>6 hrs daily) constituted 21.25% of the sample and they demonstrated. A 2.8 times higher likelihood of having DES (95% CI: 2.0-3.9, p<0.001). Additionally, age emerged as a significant factor; 16.25% of the workers aged between 40 to 50 years had DES with an odds ratio of 2.1 (95% CI: 1.5-2.9, p = 0.002). Female office workers, representing 22.5% of the sample, were 1.8 times more prone to DES (95% CI: 1.3-2.4, p = 0.004). Lastly, the environmental factor of dry conditions was associated with an increased risk, as 18.75% of those working in such conditions reported DES with an odds ratio of 2.3 (95% CI: 1.7-3.1, p = 0.001).

DISCUSSIONS

Table 1 underscores the evident association between prolonged screen exposure and the prevalence of dry eye syndrome (DES) among office workers. A significant 35% of the 400 surveyed workers reported symptoms consistent with DES. Such findings align with those of Kaltenegger *et al*.[5] who highlighted that consistent interaction with digital devices has led to an increasing trend in DES among professionals. The current data further emphasize that individuals subjected to more than 6 hrs of screen exposure daily are 2.5 times more prone to DES, a finding that mirrors the outcomes of a study by Zhang *et al*.[6] which postulated an OR of 2.3. Intriguingly, even moderate screen usage, quantified as 4-6 hrs daily, showcased a noteworthy association with DES with an odds ratio of 1.8. This result is slightly higher than the findings from a study by Mushtaq *et al*.[7] which suggested an odds ratio of 1.6 for similar screen exposure durations. The variance might be attributed to different sample populations or varying definitions of "moderate" screen usage.

However, it's crucial to juxtapose these findings with the understanding that not all screen exposure might lead to DES. In our sample, 40% of the participants with less than 4 hrs of daily screen interaction did not report DES. This resonates with the assertions of Vinnikov *et al*.[8] who emphasized that while screen usage is a salient factor, other confounding factors like ambient humidity, blink rate, and screen ergonomics play pivotal roles.

Table 2 presents a comprehensive assessment of the factors potentially influencing the prevalence of dry eye syndrome (DES) among office workers. The analysis extends beyond mere screen exposure, encapsulating age, gender and environmental conditions as possible confounders.

The pronounced association between prolonged screen exposure and DES mirrors findings from previous studies. For instance, a study by Anbesu and Lema[9] similarly reported that extensive daily screen interactions, specifically beyond 6 hrs, significantly heightened the likelihood of DES

manifestation. This corroborates our result, wherein a 2.8-fold increase in DES risk was observed for such durations.

Furthermore, age appears as a salient risk factor. Our data pinpoints that workers aged 40-50 years are 2.1 times more susceptible to DES. This aligns with the assertions of Nguyen *et al*.[10] who contended that DES prevalence intensifies with age, potentially due to age-associated alterations in tear film composition and ocular surface characteristics.

Gender differences in DES manifestation have also been previously documented. Our analysis evinced that female office workers were 1.8 times more predisposed to DES, a trend consistent with findings by Gubrele *et al*.[11]. The differential susceptibility might be attributable to hormonal fluctuations, especially those related to estrogen, which have been implicated in ocular surface diseases.

Lastly, environmental conditions, particularly dry atmospheres, have been recurrently spotlighted in literature for their exacerbating role in DES. Our results, showing a 2.3-fold DES risk in dry conditions, resonate with observations made by Bhatt *et al*.[12]. They postulated that ambient humidity levels below optimal thresholds can expedite tear evaporation rates, engendering DES.

CONCLUSION

Our cross-sectional analysis underscores a significant prevalence of dry eye syndrome (DES) among office workers, reaffirming concerns surrounding the extended exposure to digital screens in modern work environments. The association between prolonged screen time and heightened risk of DES is evident, emphasizing the importance of proactive measures to mitigate this burgeoning occupational health challenge. As the digital age progresses and screen-dependent tasks become increasingly integral to professional roles, it is paramount for workplaces to adopt strategies that balance technological needs with ocular health. This may encompass regular eye health check-ups, promoting periodic screen breaks and heightening awareness about the potential implications of prolonged screen usage. Furthermore, considering the multifactorial nature of DES, a holistic approach addressing all contributing factors, including age, gender and environmental conditions, will be essential in fostering healthier workspaces in the future.

LIMITATIONS OF STUDY

Cross-sectional nature: Given that the study design is cross-sectional, it captures data at a single point in time. Consequently, the study can identify associations but cannot ascertain causality between screen exposure and DES prevalence.

Self-reported data: The reliance on self-reported screen exposure durations and symptoms could introduce recall bias. Participants might not accurately remember or may inadvertently overstate or understate their screen time or the severity/frequency of their symptoms.

Lack of control for additional factors: While the study controlled for certain known confounders, there might be other unrecognized or unmeasured factors contributing to DES, such as dietary habits, use of contact lenses, or previous ocular diseases.

Sample diversity: If the participants were primarily from one type of office setting or a particular geographic location the results might not be generalizable to all office workers across different climates, cultures, or job roles.

Limited age range: The study focused on office workers aged 20-50 years. Thus, insights about older or younger demographics, who might also be at risk, remain unexplored.

Potential for response bias: Office workers experiencing DES might have been more motivated to participate in the study, potentially skewing the prevalence rates.

Clinical assessment limitations: The clinical tests for DES, although standardized, can be influenced by various transient factors like room humidity, recent eye activity, or time of day.

Technology variability: The study might not have considered the variations in screen types, brightness, resolution, or protective technologies, all of which can influence the risk of DES differently.

Non-consideration of break patterns: Continuous screen exposure differs from intermittent exposure with regular breaks. This study may not have accounted for the frequency and duration of breaks taken by office workers during screen activities.

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