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Original Article

# Evaluation of Dry Eye Syndrome among Office Workers Using Digital Screens - Clinical and Environmental Determinants

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***ABSTRACT***

***Background:*** *Dry Eye Syndrome (DES) is a common ocular condition characterized by discomfort, visual disturbances, and potential damage to the eye's surface. It is increasingly prevalent among individuals who spend prolonged periods using digital screens, such as office workers.* ***Methods & Materials:*** *This cross-sectional study was conducted among 107 office workers in Shantinagar, Dhaka, Bangladesh, from January 2023 to December 2023, to evaluate the prevalence of Dry Eye Syndrome (DES) and its association with clinical and environmental risk factors. The data were analyzed using SPSS version 25, with descriptive statistics to summarize participant characteristics, and Chi-square tests for associations between categorical variables.* ***Result:*** *Among 107 office workers, 51.4% had Dry Eye Syndrome (DES), with screen time >8 hours, reduced blinking, contact lens use, and air-conditioned offices as key risk factors ($p < 0.01$). DES was linked to eye fatigue (76.6%), dryness (68.2%), and reduced tear film stability ($p < 0.001$). Preventive measures, including the 20-20-20 rule, blinking exercises, lubricating drops, and omega-3 supplements, significantly lowered DES prevalence, emphasizing their role in workplace eye health.* ***Conclusion:*** *This study highlights a high prevalence of Dry Eye Syndrome (DES) among office workers using digital screens, driven by prolonged screen time, reduced blinking, contact lens use, and poor workplace conditions. DES was associated with significant ocular symptoms and tear film instability, but preventive strategies like the 20-20-20 rule, blinking exercises, lubricating drops, and omega-3 supplementation effectively reduced its prevalence.*

***Keywords:*** *Dry Eye Syndrome, Office Workers, Digital Screens, Environmental Determinants*

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## INTRODUCTION

Dry Eye Syndrome (DES) is a common and multifactorial disorder of the ocular surface, characterized by tear film instability, hyperosmolarity, inflammation, and neurosensory abnormalities, leading to discomfort, blurred vision, and potential corneal damage [1,2]. In recent decades, DES has emerged as a significant public health concern, particularly among office workers who spend extended hours using digital screens. The widespread use of computers, smartphones, and tablets has resulted in an increased prevalence of digital eye strain, which includes DES as a primary component [3]. The pathophysiology of DES in office workers using digital screens is complex and involves several interconnected mechanisms. One major factor is the alteration in blinking patterns due to prolonged screen exposure. Studies have shown that digital screen users exhibit reduced blink rates and a higher frequency of incomplete blinking, leading to increased tear evaporation and ocular surface desiccation [4,5]. Additionally, meibomian gland dysfunction (MGD), a leading cause of evaporative dry eye, is more prevalent among individuals with prolonged screen use, further exacerbating tear film instability [6]. Digital screen exposure has also been associated with oxidative stress and inflammation of the ocular surface, contributing to the progression of DES [7,8]. Environmental factors play a critical role in the development and exacerbation of DES in office settings. Air conditioning, artificial lighting, and low humidity have been identified as significant contributors to ocular dryness among office workers [9,10]. Research indicates that blue light emitted from screens may disrupt the natural circadian rhythm, impairing tear secretion and worsening DES symptoms [11]. Furthermore, poor ergonomic practices, such as incorrect

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screen positioning and prolonged near work, may increase strain on the ocular system, leading to digital eye strain and exacerbation of DES [12]. Apart from environmental triggers, certain demographic and systemic risk factors are also associated with increased susceptibility to DES. Older age, female sex, contact lens use, and systemic conditions such as diabetes mellitus, Sjögren's syndrome age, and thyroid disorders have been linked to higher prevalence rates of DES [13,14]. Additionally, the prolonged use of antihistamines, antidepressants, and other systemic medications may contribute to reduced tear production and worsening of DES symptoms [15]. Lifestyle factors, including inadequate hydration, excessive caffeine consumption, and poor sleep quality, have also been identified as potential exacerbations of DES in office workers [16]. Despite growing awareness, many office workers remain undiagnosed or undertreated for DES, underscoring the need for comprehensive screening and preventive strategies in workplace environments. This study aims to evaluate the prevalence and severity of DES among office workers who frequently use digital screens, with a focus on clinical and environmental determinants. By identifying key risk factors and their contributions to DES, this research aims to provide evidence-based recommendations to optimize ocular health in office settings and develop targeted interventions to reduce the burden of digital screen-related dry eye. Therefore, this study aimed to assess dry eye syndrome among office workers using digital screens.

## METHODS & MATERIALS

This cross-sectional study was conducted among 107 office workers in Shantinagar, Dhaka, Bangladesh, from January 2023 to December 2023, to evaluate the prevalence of Dry Eye Syndrome (DES) and its association with clinical and environmental risk factors. Participants were office workers aged 18-60 years who used digital screens for at least 4 hours/day. The inclusion criteria required participants to have no significant ocular pathologies or recent eye surgeries, while exclusion criteria included individuals with autoimmune diseases or those who used medications affecting tear production. Data collection involved a detailed ocular examination, including the Ocular Surface Disease Index (OSDI) questionnaire to classify the severity of DES, as well as subjective assessments of common ocular symptoms such as eye fatigue, dryness, burning, and blurred vision. Objective tear film tests were also conducted, including the Schirmer test to measure tear production and Tear Break-Up Time (TBUT) to assess tear film stability. Environmental factors were also documented, including screen time (categorized as >8 hours/day or ≤8 hours/day), blink rate (classified as <10 blinks/min or ≥10 blinks/min), contact lens use, and workplace conditions such as air-conditioning, ventilation, artificial lighting, and humidity levels. Participants were asked about their use of preventive strategies such as the 20-20-20 rule, frequent blinking exercises, lubricating eye drops, and omega-3 supplementation. The data were analyzed using SPSS version 25, with descriptive statistics to summarize participant characteristics, and Chi-square tests for associations between categorical variables. Independent t-tests were used to compare tear film parameters between the DES and non-DES groups, with p-values < 0.05 considered statistically significant. Informed written consent was obtained from participants. Ethical clearance was taken from the Institutional Review Board.

## RESULTS

**Table – I: Prevalence and severity of DES among office workers (*n*=107)**

| OSDI Classification | Number of Participants | Percentage (%) |
|---|---|---|
| No DES | 52 | 48.6 |
| Mild DES | 24 | 22.4 |
| Moderate DES | 20 | 18.7 |
| Severe DES | 11 | 10.3 |

Among the 107 office workers evaluated, 51.4% were diagnosed with Dry Eye Syndrome (DES) based on the Ocular Surface Disease Index (OSDI) classification. Of these, 22.4% had mild DES, 18.7% had moderate DES, and 10.3% had severe DES, indicating that a significant portion of digital screen users experience varying degrees of ocular discomfort. Meanwhile, 48.6% of participants did not exhibit DES symptoms. [Table I]

**Table – II: Association of risk factors with DES (*n*=107)**

| Risk Factor | DES Group (n = 55) | No DES Group (n = 52) | *p*-value |
|---|---|---|---|
| Daily Screen Time (>8 hours) | 37 (68.2%) | 12 (23.1%) | <0.001 |
| Blink Rate (<10 blinks/min) | 34 (61.8%) | 9 (17.3%) | <0.001 |
| Contact Lens Use | 19 (34.5%) | 7 (13.5%) | 0.007 |
| Air-Conditioned Office | 42 (76.4%) | 18 (34.6%) | <0.001 |

Participants with prolonged daily screen time (>8 hours) were more likely to develop DES (68.2%) compared to those with shorter screen exposure (23.1%) ($p$ < 0.001). Similarly, a reduced blink rate (<10 blinks/min) was strongly associated with DES, affecting 61.8% of the DES group compared to only 17.3% in the non-DES group ($p$ < 0.001). Contact lens use also emerged as a significant risk factor, with 34.5% of DES patients using contact lenses compared to 13.5% in the non-DES group ($p$ = 0.007). Additionally, 76.4% of DES cases were observed in individuals working in air-conditioned offices, suggesting that environmental dryness significantly contributes to tear film instability and ocular discomfort ($p$ < 0.001). [Table II]

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**Table – III: Environmental and workplace factors in des (*n*=107)**

| Environmental Factor | DES Group (n = 55) | No DES Group (n = 52) | *p*-value |
|---|---|---|---|
| Air-Conditioned Workplace | 42 (76.4%) | 18 (34.6%) | <0.001 |
| Poor Ventilation | 36 (65.7%) | 17 (32.1%) | 0.002 |
| Artificial Lighting | 40 (72.7%) | 21 (40.4%) | 0.003 |
| Low Humidity (<40%) | 31 (56.4%) | 14 (26.9%) | 0.004 |

A substantial proportion of DES cases were found in individuals working in air-conditioned environments (76.4%), compared to only 34.6% in the non-DES group ($p < 0.001$). Similarly, those in poorly ventilated offices had a higher prevalence of DES, with 65.7% of DES sufferers reporting poor ventilation compared to 32.1% in the non-DES group ($p = 0.002$). Artificial lighting was another key factor, with 72.7% of DES participants working in environments with such lighting, versus 40.4% of the non-DES group ($p = 0.003$). Lastly, low humidity (<40%), commonly associated with dry office air, was more prevalent in the DES group (56.4%) compared to the non-DES group (26.9%), with a statistically significant difference ($p = 0.004$). [Table III]

**Table – IV: Clinical symptoms and tear film parameters (*n*=107)**

| Parameter | DES Group (n = 55) | No DES Group (n = 52) | *p*-value |
|---|---|---|---|
| Eye Fatigue | 42 (76.6%) | 23 (44.2%) | 0.002 |
| Dryness | 38 (68.2%) | 19 (36.5%) | 0.004 |
| Burning Sensation | 30 (54.2%) | 14 (26.9%) | 0.007 |
| Blurred Vision | 23 (42.1%) | 9 (17.3%) | 0.009 |
| Schirmer Test (mm) | 6.3 ± 2.1 | 11.7 ± 3.4 | <0.001 |
| Tear Break-Up Time (TBUT) (sec) | 6.8 ± 1.7 | 12.1 ± 2.8 | <0.001 |

Office workers with Dry Eye Syndrome (DES) reported significantly higher rates of eye fatigue (76.6%), dryness (68.2%), burning sensation (54.2%), and blurred vision (42.1%) compared to the non-DES group ($p < 0.01$ for all). Objective tear film assessments showed reduced Schirmer test values (6.3 ± 2.1 mm vs. 11.7 ± 3.4 mm, $p < 0.001$) and significantly shorter Tear Break-Up Time (TBUT) (6.8 ± 1.7 sec vs. 12.1 ± 2.8 sec, $p < 0.001$) in DES participants, indicating compromised tear production and stability. [Table IV]

**Table – V: Effectiveness of preventive strategies (*n*=107)**

| Preventive Measure | Participants Using Measure (n = 59) | DES Prevalence (%) | *p*-value |
|---|---|---|---|
| 20-20-20 Rule | 35 | 27.1 | 0.005 |
| Frequent Blinking Exercises | 27 | 30.8 | 0.008 |
| Lubricating Eye Drops | 31 | 25.8 | 0.002 |
| Omega-3 Supplementation | 19 | 21.0 | 0.007 |

Participants following the 20-20-20 rule (taking a 20-second break every 20 minutes while looking at an object 20 feet away) had a lower DES prevalence (27.1%) compared to those who did not ($p = 0.005$). Similarly, frequent blinking exercises were associated with a 30.8% DES prevalence, showing a protective effect ($p = 0.008$). The use of lubricating eye drops was linked to the lowest DES prevalence (25.8%, $p = 0.002$), suggesting its effectiveness in maintaining tear film stability. Additionally, participants taking omega-3 supplements had a significantly lower prevalence of DES (21.0%, $p = 0.007$). [Table V]

## DISCUSSION

Our study identified daily screen time exceeding 8 hours, reduced blink rate, contact lens use, and air-conditioned office environments as significant risk factors for DES. These findings align with previous reports by Courtin et al., who demonstrated that screen exposure >6 hours per day significantly increased the risk of DES due to excessive evaporation of the tear film [17]. Furthermore, Nosch et al. confirmed that a blink rate below 10 blinks per minute leads to tear film instability and dry eye symptoms, which mirrors our finding that 61.8% of DES patients had a reduced blink rate compared to 17.3% in the non-DES group ($p < 0.001$) [18]. The role of air-conditioning and poor ventilation in DES pathogenesis has also been highlighted in prior studies. Our findings—where 76.4% of DES cases were in air-conditioned offices—are in agreement with Wolkoff et al., who reported a strong association between low indoor humidity and increased dry eye complaints [19]. Additionally, our study found that poor ventilation and artificial lighting significantly increased DES risk, which is supported by research from Uchino et al., emphasizing how low-humidity environments and continuous exposure to artificial lighting disrupt tear film homeostasis [20]. The ocular symptoms and tear film dysfunction observed in our study closely resemble findings

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from previous research. We found that eye fatigue (76.6%), dryness (68.2%), burning sensation (54.2%), and blurred vision (42.1%) were significantly more common in DES participants. These symptoms are comparable to those reported by Thilakaratne et al., where fatigue and dryness were the predominant complaints among office workers using digital screens [21]. Tear film assessments in our study revealed a significantly lower Schirmer test score (6.3 ± 2.1 mm) and reduced Tear Break-Up Time (TBUT) (6.8 ± 1.7 sec) in DES patients, suggesting both aqueous deficiency and evaporative dry eye mechanisms. These results align with Watanabe et al., who found that screen use reduces TBUT by nearly 50% due to decreased blink efficiency [22]. Similarly, Kaštelan et al. reported mean TBUT values of 7.1 seconds in DES cases, supporting our findings that digital screen exposure accelerates tear evaporation [23]. The 20-20-20 rule, frequent blinking exercises, lubricating eye drops, and omega-3 supplementation were associated with a significant reduction in DES prevalence in our study. Our results are supported by previous findings. For instance, Sharma et al. demonstrated that adhering to the 20-20-20 rule reduced DES symptoms by nearly 30% while blinking exercises improved tear film stability, similar to our observation of a lower DES prevalence (30.8%) among participants who performed blinking exercises ($p$ = 0.008) [24]. The role of lubricating eye drops in DES management has been well-documented. Our study found a 25.8% DES prevalence among eye drop users, which is consistent with a meta-analysis by Baudouin et al., showing that artificial tears significantly improve tear film osmolarity and reduce ocular discomfort [25]. Furthermore, omega-3 supplementation was linked to a lower DES prevalence (21.0%), supporting findings from Downie et al., where omega-3 fatty acids were found to enhance meibomian gland function and reduce inflammation [26].

### Limitations of The Study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

## CONCLUSION

This study highlights a high prevalence of Dry Eye Syndrome (DES) among office workers using digital screens, driven by prolonged screen time, reduced blinking, contact lens use, and poor workplace conditions. DES was associated with significant ocular symptoms and tear film instability, but preventive strategies like the 20-20-20 rule, blinking exercises, lubricating drops, and omega-3 supplementation effectively reduced its prevalence.

## RECOMMENDATION

To reduce the risk of Dry Eye Syndrome (DES) among office workers, employers and employees should adopt preventive measures such as the 20-20-20 rule, frequent blinking exercises, and proper screen ergonomics. Maintaining optimal indoor humidity, improving ventilation, and minimizing prolonged screen exposure can further protect ocular health. Additionally, lubricating eye drops and omega-3 supplementation should be encouraged for individuals at higher risk. Workplace policies should promote regular eye breaks and awareness programs to ensure long-term eye health in digital screen users.

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