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Prevalence and Severity of Dry Eye Disease among Visual Display Terminal Users: A Hospital-Based Study

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ABSTRACT

Background: Prolonged use of visual display terminals (VDTs) is a recognised occupational risk factor for dry eye disease (DED). With workplaces increasingly screen-dependent, quantifying the prevalence, severity and modifiable determinants of DED among VDT users is important for occupational eye care. Objectives: To estimate the prevalence and severity of DED among VDT users, and to examine associations between VDT exposure patterns and DED using both symptom (OSDI) and objective ocular-surface measures. Methods: A cross-sectional, hospital-based study of 150 VDT users assessed the Ocular Surface Disease Index (OSDI), tear break-up time (TBUT), Schirmer test and ocular-surface staining. DED was defined by symptoms plus at least one objective sign. High VDT exposure was defined a priori from daily hours and uninterrupted screen time. Associations were tested with the chi-square test, independent t test and Pearson correlation. Results: Participants had a mean age of 35.5 ± 8.4 years (59.3% male). DED prevalence was 62.7% (94/150); severity was mild in 37, moderate in 43 and severe in 14. Mean OSDI was 19.4 ± 11.0 and mean worst-eye TBUT 9.7 ± 2.5 s. OSDI correlated positively with daily VDT hours ($r = 0.63$, $p < 0.001$) and uninterrupted screen time ($r = 0.52$, $p < 0.001$), and negatively with break frequency ($r = -0.47$, $p < 0.001$). DED patients used VDTs longer than non-DED patients (8.0 vs 6.1 h/day; $p < 0.001$). High VDT exposure was strongly associated with DED (85.2% vs 50.0%; OR 5.75; $\chi^2 = 16.8$, $p < 0.001$). DED prevalence was highest in call-centre workers (86.7%). Conclusion: DED was highly prevalent among VDT users and was strongly and dose-dependently associated with longer daily screen time, longer uninterrupted use and fewer breaks. These modifiable exposures are logical targets for workplace preventive strategies.

Keywords: dry eye disease; visual display terminal; computer vision syndrome; OSDI; tear break-up time; occupational eye health..

INTRODUCTION

Dry eye disease (DED) is a common multifactorial disorder of the ocular surface and tear film that produces discomfort, visual disturbance and tear-film instability, with a measurable impact on quality of life and work productivity [1,7,9]. Among the many recognised risk factors, prolonged use of visual display terminals (VDTs) has emerged as a particularly important and modifiable occupational contributor, coinciding with the pervasive shift toward screen-based work across office, information-technology, healthcare and call-centre settings [3,6]. The mechanisms linking VDT use to ocular-surface disease are well described. Concentrated screen viewing reduces blink rate and increases the proportion of incomplete blinks, promoting tear-film instability and evaporative loss; an elevated gaze angle toward monitors widens the palpebral aperture and increases the ocular exposed surface; and air-conditioned, low-humidity environments accelerate tear evaporation [2,8]. These processes converge on the clinical picture termed computer vision syndrome, in which dry eye is the dominant contributor to symptoms of tired, irritated and dry eyes [2]. Large cross-sectional studies of office workers have confirmed the association: in Japanese VDT users, more than four hours of daily use increased the odds of clinically diagnosed DED, and the Osaka study reported a high prevalence of DED with characteristically short TBUT despite frequently normal Schirmer values [3,6]. Computer-related visual symptoms in office populations correlate with validated dry-eye scores, and contact-lens wear compounds the effect [4,5]. Symptom questionnaires and objective tear-film tests together form the basis of DED assessment. The Ocular Surface Disease Index (OSDI) is a validated, reliable instrument that discriminates disease severity and is widely used as an endpoint [1]...

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Objective signs — reduced TBUT, low Schirmer values and ocular-surface staining — complement symptoms, and contemporary case definitions require both a symptomatic and a sign component. Beyond discomfort, DED among VDT users carries demonstrable consequences for mental health and workplace productivity, underscoring its public-health relevance [7,9]. Despite a substantial international literature, continued documentation in hospital-based populations remains valuable, particularly to quantify how specific, modifiable exposure patterns — daily screen hours, uninterrupted viewing time and break frequency — relate to disease. The present study therefore estimated the prevalence and severity of DED among VDT users and examined the association of VDT exposure with both symptom burden (OSDI) and objective ocular-surface findings. The objectives were to determine DED prevalence and severity, to characterise the relationship between exposure intensity and symptoms, and to identify occupational subgroups at greatest risk.

METHODS

Participants

One hundred and fifty regular VDT users were included, spanning office/administration, information-technology, business-process-outsourcing (call-centre), healthcare and student occupational groups. Regular VDT use was defined as habitual daily screen work.

Exposure and covariate assessment

A structured proforma captured age, sex, occupation, contact-lens use, relevant systemic conditions (diabetes, thyroid disease), and VDT exposure variables: years of VDT use, hours per day, longest uninterrupted screen time, breaks per hour, viewing distance, additional smartphone hours and daily air-conditioned exposure. High VDT exposure was defined a priori from a combination of long daily hours and long uninterrupted screen time.

Ocular-surface assessment

Participants completed the OSDI (0–100). Objective tests included TBUT, the Schirmer I test and ocular-surface (Oxford) staining, recorded for each eye; the worse eye was used for case classification. DED was defined as symptomatic disease (OSDI in the symptomatic range) accompanied by at least one positive objective sign. Severity was graded as mild, moderate or severe.

Statistical analysis

Continuous variables are summarised as mean ± SD and categorical variables as counts and percentages. Associations between categorical variables (e.g., high VDT exposure and DED) were tested with the chi-square test and summarised with odds ratios; group means were compared with the independent-samples *t* test; and relationships between OSDI and continuous exposures were assessed with Pearson correlation. Two-sided $p < 0.05$ was considered significant. Analyses used Python (pandas, SciPy).

RESULTS

Participant characteristics and exposure

The 150 participants had a mean age of 35.5 ± 8.4 years; 89 (59.3%) were male. Occupational groups were office/administration (37), IT/software (35), call-centre (30), healthcare (25) and students (23). Twenty-four (16.0%) wore contact lenses and 13 (8.7%) had diabetes. Mean VDT experience was 9.4 ± 5.0 years, with a mean of 7.3 ± 2.0 hours of daily use, a mean longest uninterrupted screen time of 111.5 ± 31.4 minutes, a mean of 1.4 ± 0.9 breaks per hour and a mean viewing distance of 47.4 ± 8.1 cm (Table 1).

Prevalence and severity of DED

DED was present in 94 of 150 participants, a prevalence of 62.7% (Figure 1; Table 2). Severity was mild in 37 (24.7%), moderate in 43 (28.7%) and severe in 14 (9.3%), with 56 (37.3%) classified as no DED. By OSDI band, 47 were normal, 45 mild, 44 moderate and 14 severe. Mean OSDI was 19.4 ± 11.0, mean worst-eye TBUT 9.7 ± 2.5 s and mean worst-eye Schirmer 15.8 ± 4.6 mm — a pattern of symptomatic disease with reduced tear-film stability, echoing the short-TBUT, relatively preserved-Schirmer profile described in large VDT cohorts [6].

Association of VDT exposure with symptoms

OSDI score was strongly related to exposure intensity (Table 3). OSDI correlated positively with daily VDT hours (Pearson $r = 0.63$, $p < 0.001$) and with the longest uninterrupted screen time ($r = 0.52$, $p < 0.001$), and negatively with break frequency ($r = -0.47$, $p < 0.001$), indicating that more continuous screen work and fewer breaks accompanied greater symptom burden (Figure 2A). These gradients are consistent with the dose-response relationships reported between screen hours and dry-eye symptoms in office populations [3,4].

VDT exposure and DED

Participants with DED used VDTs significantly longer than those without DED (8.0 ± 1.5 vs 6.1 ± 1.6 h/day; $t = 6.59$, $p < 0.001$) and had longer uninterrupted screen time (120.5 vs 96.3 min; $p < 0.001$) with fewer breaks (1.18 vs 1.84 per hour). High VDT exposure was strongly associated with DED: 85.2% of highly exposed participants had DED versus 50.0% of the remainder ($\chi^2 = 16.8$, $p < 0.001$; odds ratio 5.75) (Figure 2B; Table 4). This magnitude of association is in keeping with the elevated odds of DED reported for prolonged VDT use in large surveys [3,6].

Occupational and other correlates

DED prevalence varied by occupation, being highest among call-centre workers (86.7%) and lowest among healthcare workers (52.0%), with students (60.9%), IT/software (60.0%) and office/administration (54.1%) intermediate. DED prevalence did not differ significantly by sex (χ^2 $p = 0.93$). Contact-lens wearers showed a numerically higher DED rate, consistent with the recognised additive effect of lens wear on the VDT-exposed ocular surface [5].

Table 1: Participant characteristics and VDT exposure (N=150).

Characteristic	Value
Age, years (mean ± SD)	35.5 ± 8.4
Male sex, n (%)	89 (59.3)
Occupation: office / IT / call-centre / healthcare / student	37 / 35 / 30 / 25 / 23
Contact-lens use, n (%)	24 (16.0)
Diabetes, n (%)	13 (8.7)
VDT experience, years	9.4 ± 5.0
VDT use, hours/day	7.3 ± 2.0
Longest uninterrupted screen time, minutes	111.5 ± 31.4
Breaks per hour	1.4 ± 0.9
Viewing distance, cm	47.4 ± 8.1

Table 2. Prevalence and severity of dry eye disease and ocular-surface findings (N=150).

Measure	Value
DED prevalence, n (%)	94 (62.7)
Severity: no DED / mild / moderate / severe	56 / 37 / 43 / 14
OSDI band: normal / mild / moderate / severe	47 / 45 / 44 / 14
Mean OSDI score	19.4 ± 11.0
Mean worst-eye TBUT, s	9.7 ± 2.5
Mean worst-eye Schirmer, mm	15.8 ± 4.6

Table 3. Correlation of OSDI score with VDT exposure variables (Pearson).

Exposure variable	r	*p* value
VDT hours per day	+0.63	<0.001
Longest uninterrupted screen time	+0.52	<0.001
Breaks per hour	−0.47	<0.001

Table 4. VDT exposure and dry eye disease.

Comparison	DED	No DED	Statistic
VDT hours/day (mean ± SD)	8.0 ± 1.5	6.1 ± 1.6	$t = 6.59$, $p < 0.001$
Uninterrupted screen time, min	120.5	96.3	$p < 0.001$
Breaks per hour	1.18	1.84	—
High VDT exposure, DED rate	85.2%	50.0% (not-high)	$\chi^2 = 16.8$, $p < 0.001$; OR 5.75

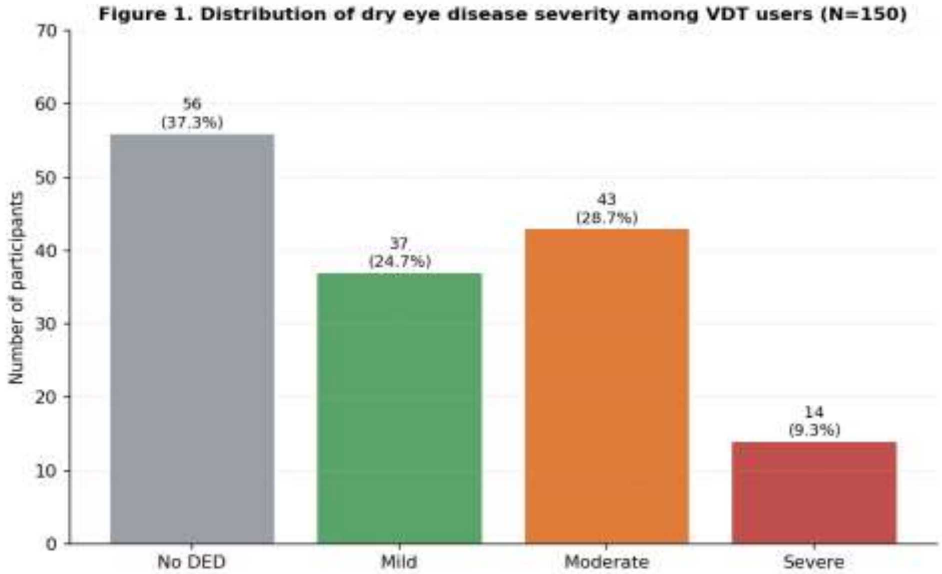

Figure 1. Distribution of dry eye disease severity among VDT users (N=150).

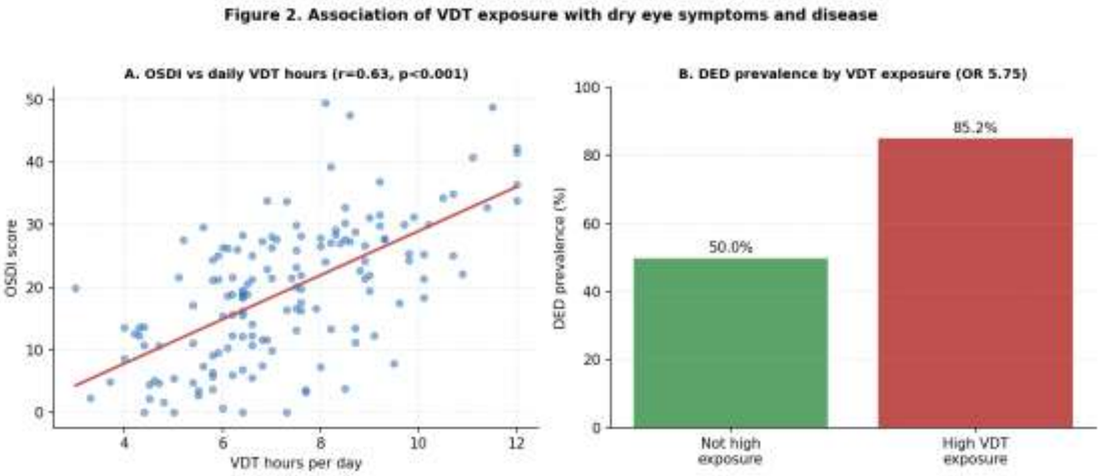

Figure 2. (A) OSDI score versus daily VDT hours with fitted regression line; (B) DED prevalence by VDT exposure category (odds ratio 5.75).

DISCUSSION

In this cross-sectional study of 150 VDT users, DED was highly prevalent (62.7%) and its symptom burden and case status were strongly, dose-dependently associated with the intensity of screen exposure. The three exposure metrics — longer daily hours, longer uninterrupted viewing and fewer breaks — each tracked with greater OSDI scores and with DED case status, and highly exposed users had nearly six-fold higher odds of disease. These findings reproduce, in a hospital-based sample, the central message of the international VDT dry-eye literature: screen exposure is a graded, modifiable risk factor for ocular-surface disease [3,4,6]. The clinical profile observed — symptomatic disease with reduced TBUT but relatively preserved Schirmer values — mirrors the evaporative, tear-film-instability phenotype characteristic of VDT-associated dry eye, in which reduced and incomplete blinking during concentrated viewing destabilises the tear film without necessarily reducing aqueous production [2,6]. This phenotype is mechanistically coherent with the negative correlation between break frequency and symptoms found here: more frequent breaks permit blink recovery and tear-film replenishment. The strong positive correlation between OSDI and uninterrupted screen time similarly implicates sustained, break-free viewing as a proximate driver of symptoms, supporting behavioural countermeasures such as scheduled micro-breaks and the widely recommended practice of periodic distant gaze during prolonged screen work [2]. The occupational gradient, with the highest DED prevalence among call-centre workers, is plausibly explained by the combination of long continuous screen and telephone work, high cognitive load with reduced blinking, and frequently air-conditioned environments — all recognised contributors to evaporative dry eye [2,8]. That contact-lens wearers showed higher DED rates is consistent with prospective work demonstrating that combined lens wear and prolonged VDT use worsens tear-meniscus and symptom measures [5]. The absence of a significant sex difference in this sample contrasts with some large surveys reporting higher female prevalence [3,6.] The implications are practical and preventive. Because the principal drivers identified here — daily screen hours, uninterrupted viewing time and break frequency — are modifiable, workplace strategies are the logical response: structured break schedules, ergonomic optimisation of monitor height and viewing distance, humidity and airflow management, judicious use of lubricant drops, and targeted screening of high-exposure groups such as call-centre staff [2]. Given the documented associations of DED with impaired work productivity and mental wellbeing, such measures carry occupational and public-health value beyond symptom relief [7,9].

CONCLUSION

In sample of VDT users, DED was highly prevalent and strongly, dose-dependently associated with longer daily screen time, longer uninterrupted viewing and fewer breaks, with highly exposed users at almost six-fold greater odds of disease and call-centre workers most affected. Because these exposures are modifiable, the findings support workplace preventive strategies — break scheduling, ergonomic and environmental optimisation, and targeted screening — to reduce the ocular-surface burden of screen-intensive work...

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