Research Article | *Cuestiones de Fisioterapia* | *Medicine*

Prevalence and Severity of Dry Eye Disease Among Computer Users: A Hospital-Based Cross-Sectional Study

Dr. Banker Mahima Suhas*

Associate Professor, Department of Ophthalmology, Indira Medical College & Hospital, Thiruvallur Taluk & Dist. Tamilnadu, India

Abstract

Background: Prolonged use of computers and visual display terminals (VDTs) is increasingly recognised as a contributor to ocular surface discomfort and dry eye disease (DED). Sustained near work reduces blink rate and increases tear-film evaporation, predisposing screen users to symptomatic dry eye. Data from South Indian populations of regular computer users remain limited.

Objectives: To estimate the prevalence and severity of DED among regular computer users attending a tertiary care teaching hospital, and to examine the relationship between patterns of computer use and symptom burden using the Ocular Surface Disease Index (OSDI).

Methods: A hospital-based cross-sectional study enrolled 220 regular computer/VDT users. Dry eye symptoms were assessed using the validated OSDI questionnaire (score range 0–100). Dry eye status and severity were classified from OSDI cut-offs (normal 0–12; mild 13–22; moderate 23–32; severe 33–100). Descriptive statistics, Pearson correlation, chi-square tests and independent-samples t-tests were applied, with $p<0.05$ considered significant.

Results: Participants had a mean age of 36.4 (SD 11.2) years; 111 (50.5%) were male. Mean daily computer use was 6.7 (SD 2.9) hours. The mean OSDI score was 36.4 (SD 12.9). DED prevalence was 98.2% (216/220; 95% CI 96.4–99.9%). Among those affected, 126 (58.3%) had severe disease. Daily computer-use hours correlated positively and significantly with OSDI score ($r=0.507$, $p<0.001$), indicating a dose-response relationship. Dry eye status did not differ significantly by screen-break habit, contact-lens use or air-conditioning (all $p>0.05$).

Conclusions: Symptomatic dry eye was near-universal and frequently severe in this selected sample of computer users, with daily screen-time hours showing a strong dose-response association with symptom severity. The near-universal prevalence should be interpreted as a feature of a highly exposed, self-selected hospital population rather than a general-population estimate.

Keywords: *Dry eye disease; Ocular Surface Disease Index; Computer vision syndrome; Visual display terminal; Tear film; South India.*

Introduction

Dry eye disease (DED) is a multifactorial disorder of the ocular surface and tear film characterised by loss of tear-film homeostasis and accompanied by ocular symptoms such as dryness, grittiness, burning, foreign-body sensation, redness and intermittent blurring of vision. It is among the most common reasons for which patients seek ophthalmological consultation worldwide, and it carries a measurable burden on visual function, comfort and work productivity. The condition arises from a combination of reduced aqueous tear production, increased tear evaporation and ocular surface inflammation, and its expression is strongly modulated by environmental and behavioural exposures.

Over the past two decades, the widespread adoption of computers, laptops, tablets and smartphones has transformed both occupational and recreational visual behaviour. Constellations of ocular and visual complaints associated with prolonged screen use are collectively described as computer vision syndrome, or digital eye strain, and include eye strain, headache, blurred vision and ocular surface dryness [2]. The ocular surface component of this syndrome overlaps substantially with DED, and prolonged visual display terminal (VDT) work is now considered an important modifiable risk factor for dry eye.

A central mechanism linking screen use to ocular surface disease is the reduction in blink rate and the increase in incomplete blinking that accompany concentrated near work. During attentive viewing of a display, the spontaneous blink rate falls markedly, and a greater proportion of blinks are partial. The result is prolonged interblink exposure of the ocular surface, accelerated tear-film thinning and break-up, and increased evaporative loss. The elevated gaze angle frequently adopted when viewing a desktop monitor further widens the palpebral aperture, enlarging the exposed ocular surface area. Together these factors promote tear-film instability and symptomatic dryness in habitual screen users [1,2].

The scale of screen exposure has risen sharply, particularly among working-age adults in information-technology-intensive economies. In urban India, employment in software, business-process and clerical sectors entails many hours of daily VDT work, often under air-conditioned conditions and with limited interruption. These features make computer users a population of particular interest for the study of occupational dry eye. Earlier work among Japanese VDT users reported a substantial prevalence of clinically diagnosed and probable dry eye, establishing screen work as an occupational risk factor for ocular surface disease [1]. Office-based surveys have similarly documented a high frequency of computer-related visual and ocular surface symptoms [2].

The Ocular Surface Disease Index (OSDI) is a validated, self-administered, 12-item questionnaire that quantifies the frequency of ocular symptoms, the impact on vision-related functioning and the influence of environmental triggers. It yields a continuous score from 0 to 100, with higher scores indicating greater severity, and supports stratification into normal, mild, moderate and severe categories. Its brevity, reproducibility and responsiveness have made it a standard instrument for both clinical and epidemiological assessment of dry eye symptom burden, and it is well suited to screening large numbers of computer users.

Despite the rapid expansion of screen-intensive occupations across South India, regional data describing the symptom burden and severity distribution of dry eye specifically among regular computer users remain sparse. Hospital-based Indian studies have reported substantial dry eye burden in clinic populations [3], yet focused characterisation of the dose-response relationship between daily screen time and symptom severity in a South Indian VDT-using cohort is lacking. Addressing this gap is relevant for occupational eye-health counselling, ergonomic intervention and resource planning. The present study therefore aimed to estimate the prevalence and severity of DED among regular computer users attending a tertiary care teaching hospital in South India, and to examine how patterns of computer use relate to OSDI-measured symptom burden.

Materials and Methods

Study design and setting

This was a hospital-based, observational, cross-sectional study conducted in the Department of Ophthalmology, a tertiary care teaching hospital in South India, over six months.

Study population

The study population comprised regular computer/VDT users aged 18–55 years who attended the outpatient department during the study period. A regular computer user was defined as a person who used a computer or visual display terminal for occupational or academic purposes on most working days.

Inclusion criteria: adults aged 18–55 years; regular use of a computer or VDT; willingness to provide informed consent and complete the questionnaire.

Exclusion criteria: known ocular surface disease unrelated to screen use, prior ocular surgery within the preceding six months, active ocular infection or inflammation, use of systemic medications known to substantially affect tear secretion, and inability or unwillingness to complete the OSDI questionnaire.

Sample size

A total of 220 eligible regular computer users were enrolled consecutively during the study period. This sample size was considered adequate to estimate the prevalence of dry eye symptoms with acceptable precision and to detect a moderate correlation between daily computer-use hours and OSDI score.

Data collection and OSDI administration

After obtaining informed consent, demographic and exposure data were recorded, including age, sex, occupation, mean daily duration of computer use (hours), total duration of computer use (years), contact-lens use, frequency of screen breaks (regular, irregular, rarely) and whether the workplace was air-conditioned.

Dry eye symptoms were assessed using the OSDI, a validated 12-item self-administered questionnaire scored from 0 to 100, with higher scores indicating greater symptom severity. Dry eye status and severity were classified using standard OSDI cut-offs: normal (0–12), mild (13–22), moderate (23–32) and severe (33–100). Participants with an OSDI score of 13 or above were classified as having dry eye disease.

Statistical analysis

Data were summarised using descriptive statistics: mean and standard deviation (SD) for continuous variables and frequencies with percentages for categorical variables. The prevalence of DED was reported with a 95% confidence interval (CI). The association between OSDI score and continuous exposure variables (daily computer-use hours and years of computer use) was assessed using the Pearson correlation coefficient. Differences in dry eye status across categorical exposures (screen-break habit, contact-lens use and air-conditioning) were examined using the chi-square test, and differences in mean OSDI scores between groups were compared using the independent-samples t-test. A p-value <0.05 was considered statistically significant.

Results

Participant characteristics

A total of 220 regular computer users were enrolled. The mean age was 36.4 (SD 11.2) years, ranging from 18 to 55 years. The cohort was balanced by sex, comprising 111 (50.5%) men and 109 (49.5%) women. The mean daily computer-use duration was 6.7 (SD 2.9) hours, and the mean total duration of computer use was 10.0 (SD 5.7) years. Occupationally, information-technology professionals formed the largest group (59), followed by clerks (50), students (49), teachers (33) and healthcare workers (29). Contact-lens use was reported by 111 (50.5%) participants, and 104 (47.3%) worked in air-conditioned environments. Screen-break habits were distributed across regular (72), irregular (79) and rarely (69) categories. Participant characteristics are summarised in **Table 1**.

Table 1. Baseline characteristics of the study participants (N=220)

Characteristic	Value
Age, years, mean (SD)	36.4 (11.2)
Age range, years	18–55
Male, n (%)	111 (50.5)
Female, n (%)	109 (49.5)
Daily computer use, hours, mean (SD)	6.7 (2.9)
Duration of computer use, years, mean (SD)	10.0 (5.7)
Occupation: IT professional, n	59
Occupation: Clerk, n	50
Occupation: Student, n	49
Occupation: Teacher, n	33
Occupation: Healthcare worker, n	29
Contact-lens use, n (%)	111 (50.5)
Air-conditioned workplace, n (%)	104 (47.3)
Screen breaks: regular, n	72
Screen breaks: irregular, n	79
Screen breaks: rarely, n	69

OSDI scores, prevalence and severity of dry eye disease

The mean OSDI score across the cohort was 36.4 (SD 12.9), with scores ranging from 6.7 to 78.2. Using the OSDI cut-off of 13 or above, dry eye disease was identified in 216 of 220 participants, giving a prevalence of 98.2% (95% CI 96.4–99.9%). Among the 216 participants with dry eye, the severity distribution was skewed towards the more severe categories: 29 (13.4%) had mild disease, 61 (28.2%) had moderate disease and 126 (58.3%) had severe disease. Thus, a majority of affected participants fell into the severe category. The OSDI findings and the prevalence and severity distribution are presented in **Table 2**.

Table 2. OSDI scores and prevalence and severity of dry eye disease

Parameter	Value
Mean OSDI score (SD)	36.4 (12.9)
OSDI score range	6.7–78.2
Dry eye disease prevalence, n/N (%)	216/220 (98.2)
95% CI for prevalence	96.4–99.9%
Mild (OSDI 13–22), n (%)*	29 (13.4)
Moderate (OSDI 23–32), n (%)*	61 (28.2)
Severe (OSDI 33–100), n (%)*	126 (58.3)

*Percentages for severity are calculated among the 216 participants with dry eye disease.

Correlation of OSDI score with patterns of computer use

Daily computer-use hours showed a positive, statistically significant correlation with OSDI score (Pearson r=0.507, p<0.001), indicating a moderate-to-strong dose-response relationship in which higher daily screen time was associated with greater symptom severity. In contrast, the total duration of computer use in years showed a weak, statistically significant negative correlation with OSDI score (r=−0.160, p=0.017). The correlation analyses are summarised in **Table 3**.

Table 3. Correlation of OSDI score with patterns of computer use

Exposure variable	Pearson r	p-value	Interpretation
Daily computer use (hours)	0.507	<0.001	Positive, significant (dose-response)
Duration of computer use (years)	−0.160	0.017	Weak negative, significant

Dry eye disease by behavioural and environmental factors

Dry eye status did not differ significantly across screen-break habit, contact-lens use or air-conditioned workplace (all p>0.05). Mean OSDI scores were comparable between participants with regular and irregular screen breaks (35.6 vs 36.6, p=0.61). These comparisons are shown in **Table 4**. The absence of significant categorical differences is largely attributable to the near-universal prevalence of dry eye in the cohort, which left little variation in dry eye status across exposure categories.

Table 4. Dry eye disease by screen-break habit, contact-lens use and air-conditioning

Factor	Category	Comparison	p-value
Screen-break habit	Regular vs irregular vs rarely	Dry eye status	>0.05 (NS)
Screen breaks (OSDI)	Regular vs irregular	35.6 vs 36.6	0.61
Contact-lens use	Yes vs no	Dry eye status	>0.05 (NS)
Air-conditioned workplace	Yes vs no	Dry eye status	>0.05 (NS)

NS = not significant.

Discussion

This hospital-based cross-sectional study of 220 regular computer users in South India yielded three principal observations. First, symptomatic dry eye, as measured by the OSDI, was near-universal, affecting 98.2% of participants. Second, the symptom burden was not only widespread but frequently severe, with a majority (58.3%) of affected participants classified in the severe category and a high mean OSDI score of 36.4. Third, and most robustly, daily computer-use hours showed a positive and statistically significant correlation with OSDI score (r=0.507, p<0.001), describing a clear dose-response relationship between daily screen time and symptom severity. We regard the high severity burden and this dose-response relationship as the most defensible and clinically meaningful findings of the study.

The dose-response association is biologically coherent and aligns with the established mechanisms linking screen use to ocular surface disease. Concentrated viewing of a display reduces blink rate and increases the proportion of incomplete blinks, prolonging tear-film exposure and accelerating tear break-up and evaporative loss [1,2]. As cumulative daily exposure rises, these effects would be expected to translate into greater symptom severity, precisely as observed in our correlation between daily hours and OSDI. Earlier work among Japanese VDT users similarly established prolonged screen work as an occupational risk factor for dry eye [1], and office-worker surveys have documented a high frequency of computer-related ocular surface symptoms [2]. Our finding extends this literature by demonstrating a quantitative dose-response gradient within a South Indian VDT-using cohort. The near-universal prevalence of 98.2%, however, must be interpreted with considerable caution and should not be read as a general-population estimate. Published prevalence figures for dry eye are substantially lower and more variable. A hospital-based study in Eastern India reported a far lower prevalence in a clinic population [3], and population-based work such as the Salnes Eye Study in Spain documented dry eye in a minority of community-dwelling adults [4]. The marked discrepancy between our figure and these reports is best explained by the nature of our sample and instrument rather than by a genuinely higher disease frequency. Our participants were a highly exposed, self-selected group of regular computer users attending a hospital outpatient department, a setting that preferentially captures symptomatic individuals. In addition, the OSDI is a symptom-based instrument, and reliance on a symptom score without confirmatory clinical signs will tend to classify a large proportion of a symptomatic, screen-intensive population as having dry eye. The most honest interpretation is therefore that the near-universal prevalence reflects an exposed and selected population assessed with a symptom questionnaire, and that the meaningful epidemiological signal lies in the severity distribution and the dose-response relationship rather than in the headline prevalence figure [5].

This near-universal prevalence also has a direct analytical consequence: it constrains the ability to detect categorical risk-factor differences. Because almost every participant met the symptom threshold for dry eye, there was minimal variation in dry eye status across exposure categories, and consequently dry eye status did not differ significantly by screen-break habit, contact-lens use or air-conditioning (all $p>0.05$). The comparable mean OSDI scores between regular and irregular screen-break groups (35.6 vs 36.6, $p=0.61$) should be read in this light. This null result is more plausibly a ceiling effect arising from near-universal prevalence than positive evidence that these factors are unimportant. Contact-lens wear and VDT work have been shown to adversely affect the ocular surface and tear function in office workers [5], and the present data should not be taken to contradict that evidence.

The weak negative correlation between the total years of computer use and OSDI score ($r=-0.160$, $p=0.017$) is statistically significant but small in magnitude, and is unlikely to be clinically meaningful. Several non-causal explanations are plausible, including adaptive behaviour and acquired ergonomic habits among long-term users, a healthy-worker or survivor effect whereby those most affected modify or reduce exposure over time, or residual confounding by age and occupation. Given its small effect size and the cross-sectional design, this finding should be regarded as hypothesis-generating rather than indicative of a protective effect of longer screen-use history [7,8].

The clinical and ergonomic implications follow directly from the dose-response finding. Because symptom severity rose with daily screen hours, interventions that reduce continuous exposure are likely to be of greatest value. The 20-20-20 rule—taking a 20-second break to view an object about 20 feet away every 20 minutes—provides a simple, teachable strategy to restore blinking and reduce sustained ocular surface exposure. Structured rest breaks, attention to workstation ergonomics including monitor height and gaze angle, optimisation of ambient humidity and airflow in air-conditioned settings, and the judicious use of lubricant eye drops form the mainstay of management. Lubricant eye drops have been shown to relieve subjective ocular discomfort in computer users [9], supporting their role as a practical adjunct for symptomatic screen workers. Workplace eye-health counselling targeting high daily screen-time users may therefore offer the most efficient means of reducing symptom burden in this population [10].

Limitations

Several limitations should be acknowledged. First, dry eye was defined on the basis of OSDI symptom scores without incorporating confirmatory clinical signs—such as tear break-up time, ocular surface staining or Schirmer testing—into the analysis, which limits diagnostic specificity and likely contributes to the very high prevalence. Second, the near-universal prevalence and the hospital-based, self-selected nature of the sample restrict generalisability to the wider computer-using population and produce a ceiling effect that hampers detection of categorical risk-factor associations. Third, the cross-sectional design precludes causal inference and prevents conclusions about the temporal relationship between exposure and symptom development. Fourth, this was a single-centre study conducted at one tertiary care teaching hospital, which may further limit external validity. These limitations notwithstanding, the dose-response relationship between daily screen hours and symptom severity is internally consistent and biologically plausible.

Conclusion

Among regular computer users attending a South Indian tertiary care teaching hospital, symptomatic dry eye was near-universal and frequently severe, and daily screen-time hours showed a strong, statistically significant dose-response relationship with OSDI-measured symptom severity. The near-universal prevalence is best understood as a characteristic of a highly exposed, self-selected hospital sample assessed with a symptom-based instrument, rather than as a general-population prevalence estimate, and it limited the detection of categorical risk-factor differences. The most defensible and actionable findings are the high severity burden and the dose-response association with daily screen time, which together support ergonomic and behavioural interventions—regular screen breaks, the 20-20-20 rule and lubricant eye drops—for computer users with high daily screen exposure. Future research using confirmatory clinical signs and population-based or longitudinal designs is warranted to refine prevalence estimates and clarify modifiable risk factors.

References

1. Uchino M, Schaumberg DA, Dogru M, Uchino Y, Fukagawa K, Shimmura S, et al. Prevalence of dry eye disease among Japanese visual display terminal users. Ophthalmology. 2008;115(11):1982-8. doi: 10.1016/j.ophtha.2008.06.022
2. Portello JK, Rosenfield M, Bababekova Y, Estrada JM, Leon A. Computer-related visual symptoms in office workers. Ophthalmic Physiol Opt. 2012;32(5):375-82. doi: 10.1111/j.1475-1313.2012.00925.x
3. Basak SK, Pal PP, Basak S, Bandyopadhyay A, Choudhury S, Sar S. Prevalence of dry eye diseases in hospital-based population in West Bengal, Eastern India. J Indian Med Assoc. 2012;110(11):789-94. PMID: 23785913.
4. Viso E, Rodriguez-Ares MT, Gude F. Prevalence of and associated factors for dry eye in a Spanish adult population (the Salnes Eye Study). Ophthalmic Epidemiol. 2009;16(1):15-21. doi: 10.1080/09286580802228509
5. Kojima T, Ibrahim OM, Wakamatsu T, Tsuyama A, Ogawa J, Matsumoto Y, et al. The impact of contact lens wear and visual display terminal work on ocular surface and tear functions in office workers. Am J Ophthalmol. 2011;152(6):933-940.e2. doi: 10.1016/j.ajo.2011.05.025
6. Skilling FC, Weaver TA, Kato KP, Ford JG, Dussia EE. Effects of two eye drop products on computer users with subjective ocular discomfort. Optometry. 2005;76(1):47-54. doi: 10.1016/s1529-

1839(05)70254-2
7. Schlote T, Kadner G, Freudenthaler N. Marked reduction and disturbance of tear secretion under visual display terminal usage. Graefes Arch Clin Exp Ophthalmol. 2004;242(4):306-312.
8. Portello JK, Rosenfield M, Bababekova Y, Estrada JM, Leon A. Computer-related visual symptoms in office workers. Ophthalmic Physiol Opt. 2012;32(5):375-382.
9. Kojima T, Ibrahim OMA, Wakamatsu TH, et al. The impact of contact lens wear and visual display terminal work on dry eye. Am J Ophthalmol. 2011;152(6):933-940.
10. Nakamura S, Kinoshita S, Yokoi N, et al. Functional visual acuity is correlated with ocular surface status in dry eye. Ophthalmology. 2010;117(9):1815-1820.