

Prevalence of Dry Eye Owing To Digital World: A Cross – Sectional Study in Adolescents

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Abstract –

Aim- The present research was conducted to study the prevalence of dry eye disease (DED) in adolescents due to long screen time doing a cross sectional study.

Methods- A cross-sectional study was conducted in 140 patients in 10 to 19 years of age. DED was diagnosed using a structured questionnaire. To determine the impact of independent variables such as age, gender, refractive error, ocular allergy, meibomian gland disease on the probability of DED, a logistic regression model was developed. Statistical analysis was performed using SPSS version 24.

Result- The mean age of study patients was 14.90±3.22 years. The prevalence of dry eye was calculated to be 34.28% (48/140). Females showed higher preponderance to dry eye than males. Prevalence of dry eye increased as the age increased, from 33% in 10-14 years to 67% in 15-19 years. Presence of refractive error ($p=0.002$) and meibomian gland dysfunction ($P=0.001$) was found to be statistically significant.

Conclusion- We estimated that 34.28% patients were diagnosed DED, prevalence is higher in females and increased with age. Forty percent of the total subjects were found to have MGD.

Keywords – Dry Eye, Meibomian Gland Dysfunction, Visual Display Terminal, Computer

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INTRODUCTION

In these modern times where the whole world is addicted to computer, television, smartphone and other electronic devices the rate of ocular diseases has increased. Specially in the past years where everyone was keeping themselves in homes to avoid this pandemic, the students were having online classes which led to increased screen time of children, thus predisposing them to the short wavelength light emitted by these devices.

Prolonged working on these devices causes visual fatigue leading to refractive errors, dry eyes, meibomian gland dysfunctions (MGD) and other diseases.

As the visual display terminals (VDT) is now part of our day-to-day life, it has caused ocular morbidities out of which dry eye and meibomian gland dysfunctions are the most common. "Dry eye is a multifactorial disease of the ocular surfaces characterized by loss of homeostasis of the tear

film, accompanied by ocular symptoms, in which tear film instability and hyperosmolarity, ocular surface inflammation and damage, and neurosensory abnormalities play etiological roles.¹ Dry eye disease (DED) presents with various symptoms, and it can significantly affect the quality of life of patients. It has physical, social, and psychological consequences because it results in impaired visual function and/or psychological problems.^{2,3}

DED is classified into 2 types: Aqueous deficient dry eye (ADDE) and Evaporative dry eye (EDE). ADDE is primarily due to lacrimal dysfunction like Sjogren syndrome and lacrimal duct deficiency. EDE happens due to conditions affecting eyelids such as MGD, diminished blinking rate and lid disorders.

Ocular symptoms of dry eye are associated with prolonged use of computer is known as computer vision syndrome (CVS)⁴. If screen is used for >3hours per day or >30hours per week CVS occurs.⁵ Common risk factors of both CVS and DED is prolonged use of screen.

MATERIAL AND METHODS

The present study was approved by institutional ethical committee and review board. All subjects were enrolled after obtaining written informed consent and in case of adolescent patients the consent was taken from the guardian of patient and ethical clearance of this study was given by the institutional review board. This cross-sectional study was conducted in the outpatient department (OPD) of ophthalmology at Santosh Medical College and Hospital, Ghaziabad, having a sample size of 140. The sample size is 140 (based on the formula, $n = Z^2pq/d^2$, where $d=0.05$ precision, $Z= 1.96$ at 95% CI; $p= 0.101737$; $q=1-p$; $n=[(1.96*1.96)*0.10*0.90]/(0.05*0.05)$; therefore $n=140$)

Patients were examined systematically and methodically. Screening was undertaken with the assistance and cooperation of the staff of OPD and the guardian of patients. Randomly selected patients of 10-19 years age group were chosen and were told about the purpose of the research. Each patient was explained about the importance of the screening of DED and its effect on the quality of life due to the usage of screens. Verbal informed consent & written informed consent was acquired from patients who were eager to go through target tests. Detailed history was obtained from all the patients with emphasis on history pertaining to dry eye. In addition, history of VDT usage including television, smartphones, tablets, laptops, etc., was also elicited and analyzed. A single examiner conducted the dry eye screening for dry eye epidemiology project (DEEP) questionnaire⁽⁶⁾. It comprises of 19 inquires, with 14 being utilized in the investigation. The inquiries secured fake tears or eye drop use, contact lens use, recurrence of visual indications,

different kinds of dryness, and hypersensitivities. The sensitivity and specificity of this survey are 0.6 and 0.94 individually. To those who were not acquainted with English, the questions were explained in their local language to the patients. Visual acuity was estimated with Snellen's Chart and retinoscopy was performed using Heine retinoscope. Slit lamp examination was conducted for ocular allergy and MGD. The patients then underwent objective tests viz Schirmer's test and fluorescein staining of the cornea for tear break-up time (TBUT).

For meibomian gland dysfunction, meibomian gland expressibility score and meibum quality score are calculated (Figure 1). For Tear break up time, Value < 10 s was considered to indicate the instability of tear film. Schirmer's test was conducted using Whatman filter paper 41. Values less than 10mm were considered dry eye.

<p>1. Quality of meibum: From lower lid or upper lid central 8 glands 0 = fluid is clear 1 = fluid is cloudy 2 = fluid is cloudy particulate 3 = secretion is inspissated, like toothpaste.</p> <p>IIa. Expressibility of meibum: lower lid or upper lid central 8 glands 0 = expressible from all glands 1 = expressible from 3-4 glands 2 = expressible from 1-2 glands 3 = no glands expressible</p> <p>IIb. Expressibility of meibum: lower lid nasal or central eight Glands Score = I plus IIa or IIb In ≤ 20 years: for quality or expressibility, score >1 is abnormal. In >20 years: for either quality or expressibility, score = 1 is taken as normal; a score = 1 for both, or of >1 for either, is taken as abnormal.</p>
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Figure 1: Parameters for assessment of Meibomian gland dysfunction

STATISTICAL ANALYSIS

Data were collected and statistical analysis was performed using SPSS version 24. Descriptive data were stated as mean \pm standard deviation. A P-value less than 0.05 was deliberated to be statistically significant. Dichotomous variables were compared using chi-square tests. To determine the impact of independent variables such as age, gender, refractive error, ocular allergy, MGD and VDT use on the probability of DED, a logistic regression model was employed.

RESULTS

The mean age of patients was 14.90 ± 3.22 years (range, 10-19 years). There were 82(58.5%) males and 58(41.4%) females. All the students were having online classes and the screen time was >3hours a day. Majority of patients were males in the age group of 15-19yrs (59.4%). (Table-1)

Table 1 – Demographic Distribution

AGE GROUPS (YEARS)	Males (n%)	Females (n%)	Total (N%)
10-14	35 (57.37)	26 (42.62)	61 (43.57)
15-19	47 (59.4)	32 (40.5)	79 (56.42)
TOTAL	82 (58.5)	58 (41.4)	140

To diagnose DED, the tests carried out were Schirmer's and TBUT, along with a questionnaire. TBUT were found to be reduced in 48 subjects, while Schirmer's was reduced in 4 subjects. The positive and negative predictive value for DEEP questionnaire was found to be 99.98% and 67.65% respectively. A total of 20/48 showed high score in the questionnaire and 48/140 patients had DED. Thereby, making the prevalence to be 34.28%. The mean age of patients with DED was 15.65±2.99 years. Out of the total males and females, 27(33%) and 21(36%) had DED respectively. (Figure- 2)

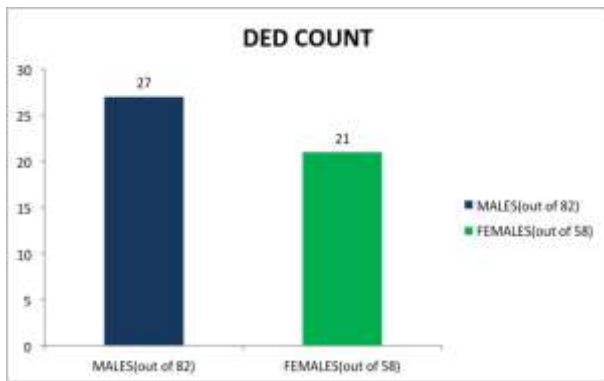


Figure 2 – Gender Distribution among DED Patients

The numbers of patients with symptoms were 69(49.3%). Among these symptomatic patients DED was diagnosed in 30(43.47%) patients while in asymptomatic group DED was present in 18(25.35%) patients. The difference of symptoms between patients with and without DED was significant (P=0.0374). (Figure-3)

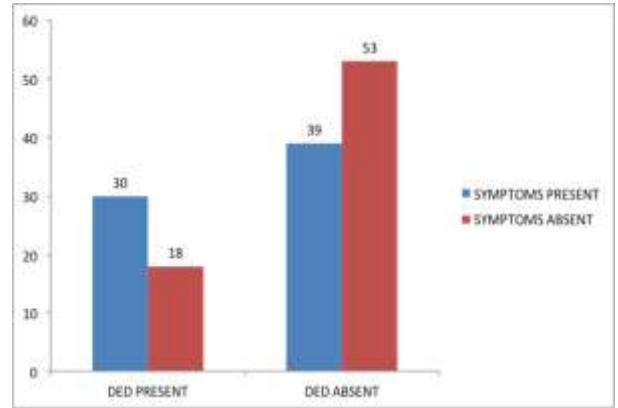


Figure 3 - The distribution of symptoms in patients with DED

Refractive error was present in 56 (40%) patients of the total. The difference between refractive error in patients with and those without DED was significant (P=0.002). Ocular allergy was present in 50.7% of the subjects. The difference between ocular allergy in patients with and without DED was significant (P=0.093).

To know the status of MGD, meibomian gland expressibility (MES) and meibum quality (MEQ) scores are calculated. Figure 4 shows the number of patients having abnormal scores. 40% of the total subjects were found to have MGD. The difference between MGD in patients with and without DED was significant (P=0.001). (Table-2)

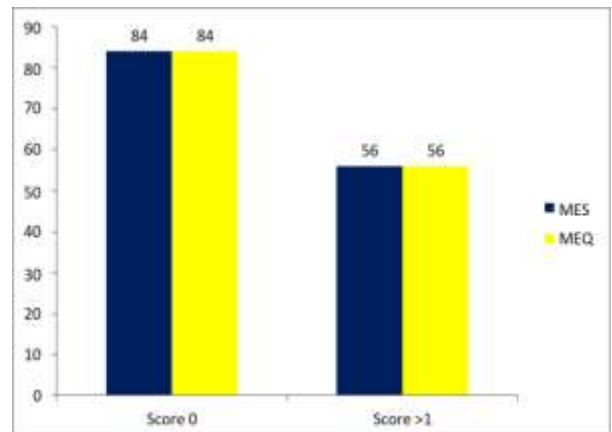


Figure 4 – No. of patients with abnormal scores

Table 2 – The number of patients with MGD having DED

	DED PRESENT	DED ABSENT	TOTAL
MGD PRESENT	31 (55.3%)	25 (44.6%)	56 (40%)
MGD ABSENT	17 (20.2%)	67 (79.7%)	84 (60%)
TOTAL	48 (34.2%)	92 (65.7%)	140

On binomial logistic regression to ascertain the effects of age, gender, refractive error, ocular allergy, Meibomian gland disease use on the likelihood that participants having DED, the logistic regression model was statistically significant, $\chi^2(5) = 39.609$, $p < .001$. The model elucidated 33.7% (Nagelkerke R²) of the variance in DED and appropriately categorized 75.7% of cases. Of the 5 predictor variables only, three were significant: refractive error, ocular allergy, Meibomian gland disease (as shown in Table 3).

Table 3 – Binomial logistic regression

INDEPENDENT VARIABLES	B	S.E.	WALD	Sig.	95% C.I. for EXP(B)	
					Lower	Upper
Age	-.470	.436	1.163	.281	.266	1.469
Gender	.193	.431	.201	.654	.521	2.826
RefractiveError	1.380	.438	9.951	.002	1.686	9.371
Ocular Allergy	.949	.564	2.827	.093	.855	7.801
Meibomian Gland Disease	1.869	.565	10.961	.001	2.144	19.603

Variables entered on Step 1: age, gender, refractive error, ocular allergy, Meibomian gland disease

DISCUSSION

Dryness of eyes is a quite common eye disease nowadays. it has become a vital public health problem. In assessing the degree of ocular irritation and dry eye conditions, more than the volume of aqueous tear the meibomian gland plays a significant role. MGD can result in tear film modification, eye irritation and inflammation which is noticeable clinically⁷.

In the current society, the utilization of computers and computerized electronic gadgets is omnipresent for both professional and non-professional exercises, including email, web access and diversion. Expanded utilization of tablets, and personal computer, by youth and teenagers over the most recent years has brought about a exercising prevalence of dry eye patients. The blue light outflow from VDTs can smother the synthesis of melatonin, which may prompt interruption of rest cycle, in the long run influencing their calling which needs legitimate visual consideration.

The current study is an attempt to provide a holistic assessment of dry eye in adolescents that may be important for this public health problem. In the present study, patients in the age set of 10-19 years were studied. Mean age of study patients were 14.90 ± 3.22 years. The majority of patients were males (59%). Out of the total males and females, 27(33%) and 21(36%) had DED respectively. There was no statistical significance. Our results were similar to the study by Jeewn et. al. as there was no statistical significance in the severity of the disease between males and females ($P = 0.18$).⁸ However Ayaki et al recorded that the prevalence of DED was

10.8 percent and 22.1 percent for late adolescent boys and girls, 13.0 percent and 12.8 percent for early adolescent boys and girls.^[9]

In our present study, TBUT was found reduced in all the patients diagnosed to have dry eye disease showing significant relation of TBUT with DED. Ramachandraiah et al reported that TBUT was found to have a sensitivity of 46.4% and specificity of 100%.^[10]

In the present study only 4 out of 48 with DED had a positive Schirmer's test. Jeewn et al reported that an abnormal Schirmer's test value was observed in only 5.3% cases.^[8]

The present study showed that 69/140 had symptoms of dry eye and 30 out of these 69 had DED. The difference of symptoms between patients with and without DED was significant ($P=0.0374$). In our present study refractive error was present in 56 (40%) patients. There was a noteworthy difference between refractive error in patients with and without DED. ($P=0.0001$).

Ocular allergy was present in 50.7% of the subjects in this study. There was a noteworthy contrast between ocular allergy in patients with and without DED ($P=0.0108$). However, Kim et al reported that in pediatric patients, TBUT was more limited and the quantity of manifestations identified with dry eyes was higher with unfavorably susceptible conjunctivitis as compared to those without it.^[11]

In the present study 40% of the total subjects were found to have MGD. There was a substantial difference between MGD in patients with and without DED ($P=0.0001$). According to Wand et al in contrast with the normal group, the meibomian gland dropout scores, meibomian gland orifice scores and meibomian gland secretion scores were significantly higher in the dry eye group ($P<0.0001$).^[12]

Adolescents with allergic conjunctivitis frequently blink and rub their eyes which may intensify inflammation of the eye surface and damage the corneal epithelium, leading to changes in the composition and stability of the tear film, all of which are associated with dry eye. MGD can result in tear film alteration, eye irritation symptoms, clinically evident inflammation, and ocular surface disease. TBUT is affected significantly among VDT users which show that tear film becomes unstable by their usage, hence helps in finding actual correlation of dry eye with use visual display terminals. Moreover, TBUT may hold good diagnostic accuracy, may detect early dry eye change.^[15,16]

Chief restriction of our examination is that the sample size of our investigation is little, and the length of the examination is more limited, in this

way it can't characterize the issue among the summed-up population. We included only 10-19 years old patients so prevalence before 10 years and beyond 19 years cannot be calculated. Moreover, the sample for the present study was drawn from the outpatient department in a level 3 hospital and not from the community. Thus, the external validity of the study may be limited.

CONCLUSION

The mean age of study patients was 14.90 ± 3.22 years. The prevalence of dry eye was calculated to be 34.28%. Prevalence of dry eye increased as the age increased, from 33% in 10-14 years to 67% in 15-19 years. Presence of refractive error was found to be significant in relation to dry eye, $P=0.002$. Meibomian gland dysfunction was found statistically significant with $P=0.001$.

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None

Conflict of interest

There are no conflicts of interest

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