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Research Article

Dry Eye Disease Prevalence and Risk Factors in Eye Outdoor Patients Visiting a Tertiary Care Center: A Prospective Observational Study

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Abstract

Purpose: A prospective observational study was conducted to determine the prevalence and associated risk factors of dry eye disease among patients visiting the outpatient department of ophthalmology in a tertiary care center.

Methods: Five hundred randomly selected patients (n = 500) visiting the Regional Institute of Ophthalmology, Amritsar were examined and classified as diagnosed cases of dry eye disease (DED) fulfilling a minimum of three criteria including Schirmer test 1 <15 mm, tear film break up time (TBUT) <10seconds, Ocular Surface Disease Index (OSDI) questionnaire score >13, meibomian gland dysfunction (MGD) on slit lamp examination, Rose Bengal staining (RSBT) and fluorescein staining status, while those with none, one, or two positive tests were considered as controls without DED.

Results: The prevalence of DED was 51.40% in the present study. Older age, meibomian gland dysfunction (81.5%), visual display terminal use (63.5%), use of topical anti- glaucoma drugs (80%), certain occupational groups, history of refractive surgery (78.1%), contact lens use (87.5%), smoking (84.2%), connective tissue disorder (100%) and diabetes mellitus (68.4%) were identified as significant risk factors ($p < 0.05$) associated with dry eye disease.

Conclusion: This study suggests that the prevalence of DED and several other risk factors are significantly associated with the development of DED, shedding light on the multi factorial nature of this condition. These results emphasize the importance of educating patients regarding the various risk factors associated with DED and lifestyle modifications.

Keywords: Prevalence; Risk Factors; Dry Eye Disease; Meibomian Gland Dysfunction

Abbreviations

DED: Dry Eye Disease; TBUT: Tear Film Break up Time; OSDI: Ocular Surface Disease Index; MGD: Meibomian Gland Dysfunction; RSBT: Rose Bengal Staining; TFOS: Tear Film and Ocular Surface Society; DEWS: Dry Eye Workshop; VDT: Visual Display Terminal

Introduction

The Tear Film and Ocular Surface Society (TFOS) Dry Eye Workshop II (DEWS) defines dry eye disease (DED) as a multi factorial disease of the ocular surface characterized by a loss of homeostasis of the tear film and accompanied by ocular symptoms, in which tear film instability, hyperosmolarity, ocular surface inflammation, and neurosensory abnormalities play etiological roles [1]. DED symptoms are estimated to affect up to 50% of the global population and can vary widely among individuals including sensations of dryness or foreign bodies in the eyes, grittiness, burning, itching, watering, sensitivity to light, redness and blurred vision which can significantly impact daily activities such as reading, driving and using digital devices.

Several risk factors contribute to the development of DED including aging, hormonal changes, systemic disease, certain medications and lifestyle factors such as prolonged screen time and contact lens wear [2]. Assessing these risk factors in routine OPD

patients is critical for early detection and management of dry eye disease, as it has significant implications for a patient's quality of life and may also impact visual function.

The future prevalence of dry eye is expected to increase owing to longer life expectancy and the increasing use of computers and smart phones for intensive visual tasks. Previous studies have reported a wide range in the prevalence of DED with estimates ranging from 18.4% to 54.3% [2,3].

The prevalence of dry eye varies significantly owing to differences in methodologies, diagnostic criteria, patient demographics, and geographical locations. Standardized diagnostic criteria for dry eye are currently lacking, which impedes efforts to understand the epidemiology of the disease and to develop effective management and treatment strategies. A comprehensive understanding of the epidemiology of DED within the outpatient population, including the identification of risk factors, such as lifestyle, systemic, or demographic factors in the Indian context, is necessary for public awareness and global comparisons.

Methods

After obtaining ethical clearance from the institutional committee and written informed consent from all enrolled patients, a prospective observational study was conducted for 2 years on 500 randomly selected patients from the outpatient department visiting the Regional Institute of Ophthalmology in a tertiary care center. Inclusion criteria included 1) patients ≥ 20 years of age who presented with symptoms such as burning or foreign body sensation, blurring of vision, ocular fatigue, itching, stinging, redness, intolerance to light, dryness, photophobia, stickiness and watering of eyes. Exclusion criteria included 1) patients < 20 years of age 2) history of life-threatening systemic disease 3) history of acute ocular infections 4) history of extra-and intraocular surgery within the last 6 months 5) gross lid abnormalities 6) presence of a foreign body or trichiasis.

Diagnosis and confirmation of DED was performed using one subjective and five objective tests in standard order. The ocular surface disease index (OSDI) questionnaire, detailed Slit lamp examination for identification of patients with MGD and chronic blepharitis, Tear film breakup time (TBUT), Fluorescein dye staining test , Rose Bengal staining test and Schirmer 1 test were performed.

All tests were performed in both eyes of the patients. An OSDI questionnaire score >13, TBUT <10 seconds and Schirmer 1 test < 15 mm were considered positive. For Schirmer 1 and TBUT the average values of the two eyes were calculated. Slit lamp examination, Fluorescein dye staining and Rose Bengal staining tests were considered positive if one or both eyes of the patients tested positive. A criterion for diagnosing DED in patients was DED present if ≥ 3 tests were positive and DED was not present if none, 1 or 2 tests were positive. Patients who did not fulfil the above criteria were used as controls.

Additional information was analyzed for all patients including age, occupation, history of diabetes mellitus, smoking, contact lens use, use of topical anti-glaucoma drugs, environmental factors, visual display terminal use, connective tissue diseases, history of refractive surgery, ocular trauma, chronic allergy, thyroid disorder, psychiatric illness and symptoms experienced by the patients.

Data from our study were systemically collected and compiled and the risk factors associated with DED were recorded. Data were statistically analyzed using IBM Statistical Statistics for Social Sciences (SPSS) version 21 (IBM). The chi-square test and Student's t-test were used to determine significant differences between the two categories. $P < 0.05$ was considered significant (95% confidence interval).

Results

The prevalence of DED was 51.40% in the present study. The mean age of cases (52.58+/-13.703 years) was statistically higher than the mean age of controls.

No significant association was observed between gender and dry eye ($p > 0.05$). A highly significant association with MGD was observed in 81.5% of dry eye cases. The prevalence of DED was 62.6% in the outdoor working group compared to indoor workers (46.4%). The highest prevalence of DED was associated with VDT use > 6 hours (63.9%), followed by 2–6 hours (62.7%) and <2 hours (43.1%), thus showing a high association between VDT use and DED. A significant association was observed between DED and history of diabetes mellitus ($p < 0.05$), history of topical anti glaucoma drugs ($p < 0.001$), refractive surgery, connective tissue disease, contact lens use and smokers ($p < 0.05$) whereas no signifi-

Age (years)	
20-50 (n = 260)	112 (43.6%)
51-70 (n = 215)	122 (47.5%)
>71 (n = 25)	23 (8.9%)
Total (n = 500)	257
Gender	
Male (n = 224)	122 (47.5%)
Female (n = 276) Female (n = 276)	135 (52.5%)
Total (n = 500)	257
Occupation	
Computer workers (n = 41)	20 (48.8%)
Drivers (n = 11)	9 (81.8%)
Employees (n = 91)	38 (41.8%)
Farmers (n = 116)	69 (59.5%)
Housewives (n = 189)	94 (49.7%)
Labourers (n = 28)	19 (67.9%)
Students (n = 24)	8 (33.3%)
Total (n = 500)	257 (51.4%)

Table 1: Demographical profile of dry eye patients.

Type of Symptoms	Symptoms present in dry eye patients (n = 257)
Itching	70 (27.2%)
Grittiness	62 (24.1%)
Watering	65 (25.3%)
Pain	22 (8.6%)
Photophobia	9 (3.5%)
Heaviness	31 (12.1%)
Redness	12 (4.7%)
Blurring	7 (2.7%)
Burning sensation	64 (24.9%)

Table 2: Various symptoms of dry eye disease.

cant association was observed with a history of thyroid disorder and ocular trauma ($p > 0.05$).

Discussion

Smoothness of the precorneal tear film and ocular surface clarity are of paramount importance in maintaining normal optical function. The presence of a precorneal tear film was first demonstrated by Fischer in 1928 [3] and further by Rollet [4]. Dry eye disease is one of the most common ophthalmic disorders encountered in outpatient department.

The prevalence of DED in various population and hospital based studies varies between 7.7% and as high as 73.5% [5,6]. A study conducted in China found a prevalence of DED of 52.4% [7]. Another study conducted by Shah., *et al*. in 2015 also reported a prevalence of DED of 54.3% [2]. In our study, the prevalence of DED was found to be 51.4%.

The mean age of cases in present study was 52.58+/-13.70 years while it was 46.20+/-12.04 years in controls. In the present study, DED was significantly associated with increased age ($p < 0.001$). A cross sectional study in Jordan also found a high association of dry eye symptoms in older age > 45 years [8]. Similar to this the prevalence of dry eye was also observed to be significantly higher (36%) in the older age groups (>70 years) in a cross sectional study done in the year 2005, as compared to all other age groups followed by the age group 31-40 years (20%) [9].

The hourly use of television, mobile phones, computers and laptops was observed to have a significant correlation with DED. We observed that the maximum prevalence of DED was in patients with visual display terminal (VDT) use for more than 6 hours (63.9%) followed by 2 to 6 hours (62.7%) and less than 2 hours (43.1%). A study conducted in 2005 found a higher prevalence of dry eye among computer users [9]. Another study done in North India found that 89.98% of patients with 4 hour or more of VDT usage were associated with severe dry eye [10].

	DED positivecases (n = 257)		DED negativecases (n = 243)		Total	P value	Statistical Significance
	Number	%	Number	%			
Symptomatic patients	172	66.9%	93	38.3%	265	<0.001	Highly significant
Non-symptomatic patients	85	33.1%	150	61.7%	235		
Gender							
Male	122	47.5%	102	42%	224	>0.05	Not Significant
Female	135	52.5%	141	58%	276		
MGD	106	81.5%	24	18.5%	130	<0.001	Highly significant
Occupation							
Indoor	160	46.4%	185	53.6%	345	<0.05	Significant
Outdoor	97	62.6%	58	37.4%	155		
VDT Use in Hours							
No VDT Use	42	36.5%	73	63.5%	115	<0.001	Highly Significant
<2 Hours	62	43.1%	82	56.9%	144		
2 to 6 Hours	52	62.7%	31	37.3%	83		
>6 Hours	101	63.9%	57	36.1%	158		
Diabetes							
Non diabetic	205	48.3%	219	51.7%	424	<0.05	Significant
diabetic	52	68.4%	24	31.6%	76		
Thyroid disorder							
No	240	50.8%)	232	49.2%)	472	>0.05	Not Significant
Yes	17	60.7%)	11	39.3%)	28		
Patients on Anti-Glaucoma Drugs							
No	229	49.2%	236	50.8%	465	<0.001	Highly Significant
Yes	28	80.0%	7	20.0%	35		
Patients on Anti-Psychotic Drugs							
No	252	51.1%	241	48.9%	493	>0.05	Not Significant
Yes	5	71.4%	2	28.6%	7		
History of Refractive Surgery							
No	232	49.6%	236	50.4%	468	<0.05	Significant
Yes	25	78.1%	7	21.9%	32		
Chronic Allergy							
No	248	51.1%	237	48.9%	485	>0.05	Not Significant
Yes	9	60.0%	6	40.0%	15		

Connective tissue disease							
No	249	50.6%	243	49.4%	492	<0.05	Significant
Yes	8	100.0%	0	(0.0%	8		
History of ocular trauma							
No	253	51.1	242	48.9%	495	>0.05	Not significant
Yes	4	80.0%	4	80.0%	5		
Contact lens use							
no	250	50.8	242	49.2%	492	<0.05	Significant
yes	7	87.5%	1	12.5%	8		
Smoking							
Non smokers	241	50.1%	240	49.9%	481	<0.05	Significant
Smokers	16	84.2%	3	15.8%	19		

Table 3: Showing various risk factors associated with dry eyes.

A significant association was observed between meibomian gland dysfunction and DED ($p < 0.001$). A study done in 2004 also found MGD to be the most common cause of evaporative dry eye [11]. A study done in Spain in 2011 and a cross sectional study in 2012 also found association of dry eye and MGD [12,13].

In the present study, the prevalence of DED was found to be significantly higher (62.6%) in occupations related to outdoor work (farmers, laborers, and drivers) than in indoor workers (46.4%). In 2015, a hospital-based study in Southeast China also observed that exposure to adverse environments was a risk factor for dry eye syndrome. In contrast to our findings, a study conducted in 2010 reported that occupation had no effect on the risk of dry eye ($P = 0.952$) [15].

The correlation between contact lens use and DED was significant ($p < 0.05$) in the present study and the prevalence of DED in contact lens users was 87.5%. A study conducted in Japan in year 2011, Beaver Dam Offspring Study in 2014 and a study in Jordan 2016 also found that contact lens use was a risk factor for DED [6,8,16].

There was significant association of DED with other risk factors like history of diabetes mellitus, refractive surgery (mostly cataract), connective tissue disease, smoking and use of anti-glaucoma drugs [2,9,17-20].

Limitation

The main limitation of our study is that it is a hospital-based study which by itself increases the prevalence compared to a study conducted in a community. Further population-based studies are needed to assess the prevalence of DED more accurately and to establish a concrete etiological association with various risk factors.

Conclusion

The high (51.40%) prevalence of DED in our study reflects it as a major burden among routine-out patients. Risk factors precipitating or worsening DED include older age, visual display terminal use, meibomian gland dysfunction , outdoor work occupations such as farmers, laborers and drivers, diabetes mellitus, use of topical anti-glaucoma drugs, use of antipsychotics and anti allergics, history of ocular trauma, history of refractive surgery, contact lens use and smoking. These contributing factors need to be emphasized for a more systematic, targeted and effective approach to DED. Identification of these factors would not only improve vision-related quality of life and decrease ocular health burden but also minimize the huge economic burden on society.

Conflicts of Interest

There are no conflicts of interest.

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