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Original Article

Prevalence and Risk Factors of Dry Eye Disease: Ocular Surface Disease Index and Tear Film Break up Time Based Study

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Abstract

Introduction: Dry eye disease (DED) is one of the common ophthalmological conditions and is a growing public health problem.

Aims: The aims of this study are to assess the prevalence of DED and its associated risk factors.

Materials and Methods: A total of 600 patients with age more than 20 years who visited the ophthalmology outpatient department of a tertiary care center were selected randomly. The study design was a prospective, cross-sectional, and observational study. An ocular surface disease index (OSDI) questionnaire was administered to all participants and individuals with OSDI score >13 was further evaluated with tear break-up time (TBUT). Diagnosis of DED was made on the bases of OSDI score more than 13 and TBUT <10 s. The data were compiled and subjected to statistical analysis.

Results: Prevalence of dry eye in our study was 33.66%. Use of Visual display terminal, outdoor occupation, refractive surgery, use of topical anti-glaucoma drugs, use of contact lens, smoking, connective tissue disorder, and diabetes mellitus were identified as significant risk factors associated with DED.

Conclusions: DED is a common condition. We recommend the screening of all out-patients by TBUT, which is a simple and reliable test. Patients should be educated regarding the various risk factors associated with DED and about lifestyle modifications.

Key words: Dry eye disease, Ocular surface disease index, Tear break-up time

INTRODUCTION

Dry eye disease (DED) is a disease of the ocular surface commonly presented in clinical practice. Tear Film and Ocular Surface Society Dry Eye Workshop II report published in July 2017 defined DED as a multifactorial 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]

The core pathophysiological process of dry eye is contributed by reduced aqueous tear flow and increased evaporation leading to hyperosmolarity. Hyperosmolarity further damages the epithelium of ocular surface and sets off a cascade of inflammatory pathways within surface epithelial cells. After inflammatory pathways sets off the mediators, there occurs loss of goblet cells and epithelial cells, epithelial glycocalyx damage, apoptotic cell death, mucus production deficiency leading to punctate epitheliopathy of dry eye, and tear film instability. All these factors ultimately lead to early break up of tear film.

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Vicious cycle events are completed in this way by tear film break up which amplifies hyperosmolarity and ocular surface damage.[2]

In a study conducted in India in 2010, the prevalence of dry eye based on ocular surface disease index (OSDI) was found to be 29.25%.[3] A survey conducted by an American academy of ophthalmology in 2014 reported that around 30% of patients seeking treatment from an ophthalmologist have symptoms consistent with DED.[4]

Dry eye causes a significant discomfort on the everyday life, which indirectly influence overall economy of a nation. To the best of our knowledge, no study has been conducted to describe the prevalence of DED in this border area of India, this study was conducted to assess the prevalence of DED and to identify the associated risk factors.

MATERIALS AND METHODS

We conducted a prospective, cross-sectional, hospital-based, and observational study involving 600 patients who visited ophthalmology outpatient department at a tertiary care center. Patients of more than 20 years of age with various complaints may or may not related to dry eye were randomly selected from the outpatient department. Our study sample includes mixed population of both rural and urban areas The study was approved by the Institution Ethical Committee. Written informed consent from all the patients enrolled in the study was obtained in their vernacular language, in accordance with the Declaration of Helsinki.

Patients <20 years of age, patients with history of acute ocular infection; inflammation or allergic conjunctivitis, patients with gross lid abnormalities, and patients with history of extra or intraocular surgery within past 6 months were excluded from the study.

Comprehensive history pertaining to dry eye and history of visual display terminal (VDT) usage including television, smartphones, tablets, and laptops was obtained from all the patients.

Data regarding the systemic and ocular risk factors causing or triggering DED such as diabetes, thyroid disorder, connective tissue disease, use of topical anti-glaucoma drugs, refractive surgery, ocular trauma, contact lens use, and smoking were recorded.

A scientifically validated OSDI questionnaire was administered to all participants to assess the symptoms of dry eye. The questions were explained to the patients in their vernacular language by a single trained ophthalmology resident. The OSDI questionnaire is a subjective symptom questionnaire that includes 12 items, with each question given a score ranging from 0 (none of the time) to 4 (all of the time). The patients had to assign a score based on duration of symptoms experienced over the preceding week. The final score was calculated by multiplying the sum of all the scores with 25 and then dividing the total by number of questions answered.[5]

Patients with OSDI score >13 further underwent a general ophthalmic assessment along with slit lamp examination and tear break-up time (TBUT). TBUT was performed in all participants by a single observer.

Tear film break up time: It was used to assess the stability of precorneal tear film. It is considered to be a reliable and repeatable test for dry eye and is minimally invasive.[6] TBUT has been reported to be low in different types of dry eye including keratoconjunctivitis sicca, mucin deficiency, and meibomian gland disease.[7] It was performed by moistening a 2% fluorescein strip with normal saline and placing it in the inferior fornix in non-anesthetized eye. The patient was asked to blink eyes once or twice. The tear film was evaluated using broad beam of slit lamp with a cobalt blue filter. The time interval from the last blink to the appearance of the first randomly distributed dry spot on the cornea was noted. The test was repeated thrice and the mean value was calculated. Value of <10seconds was considered as indicative of tear film instability.

Diagnosis of DED was made on the bases of OSDI score >13 and TBUT <10 s.

Statistical Analysis

Average of results of OSDI and TBUT of both eyes was considered for analysis purpose. The descriptive statistics were used to express data on terms of percentage.

$$\text{Prevalence of dry eye} = \frac{\text{Number of patients diagnosed with dry eye}}{\text{Total number of patients included in the study}}$$

RESULTS

A total of 600 patients participated in the study. The prevalence of dry eye in our study was 33.66%. The prevalence of dry eye among female patients was 38.65% and among male patients was 27.73%. The prevalence of

dry eye among urban population was 41.06% and among rural patients was 17.20%. We assessed the prevalence of dry eye among various occupation groups and found maximum prevalence of dry eye among computer operators (68.18%), the prevalence of DED was higher in individuals using VDT for >6 h (63.9%) followed by 2–6 h (62.7%) and <2 h (43.1%) users, thus showing high association of VDT use with DED.

[Table 1] shows prevalence of dry eye according to age, sex, place of residence, and occupation.

Systemic risk factors associated with dry eye was connective tissue disease (75%), thyroid disorder (60.7%), and diabetes mellitus (42.1%). The prevalence of dry eye in patients with history of topical anti-glaucoma drugs was 80%, refractive surgery 78.1%, contact lens use 62.5%, and in smokers 57.89%.

[Table 2] shows prevalence of various risk factors associated with DED.

Table 1: Prevalence of dry eye according to age, sex, place of residence and occupation

Demographic characteristics	Number of patients *n*=600	Dry eye presents *n*=202	Prevalence Percentage
Age in years			
20–29	69	22	31.88
30–39	130	53	40.76
40–49	139	61	43.88
50–59	107	35	32.71
60–69	90	19	21.11
70–79	40	8	20.00
>80	25	4	30.76
Gender			
Male	274	76	27.73
Female	326	126	38.65
Rural	186	32	17.20
Urban	414	170	41.06
Occupation			
Computer operator	66	45	68.18
Housemakers	189	38	20.10
Students	24	13	54.16
Office employees	96	44	45.83
Drivers	13	5	38.46
Farmers	126	42	33.33
Laborer/Factory worker	28	10	35.71
Others*	58	6	10.34

*Tailors, jobless, carpenter, electricians

Table 2: Prevalence of various risk factors in dry eye disease

Study factors	Number of patients	Dry eye patients	Prevalence percentage of dry eye
History of diabetes	76	32	42.1%
History of thyroid disorder	28	17	60.7%
History of connective tissue disease	8	6	75%
Use of topical anti-glaucoma drugs	35	28	80%
History of refractive surgery	32	25	78.1%
History of Contact lens use	8	5	62.5%
History of Smoking	19	11	57.89%

DISCUSSION

The prevalence of DED in various population and hospital-based studies varies between 7.7% to as high as 73.5%.[8,9] In our study, the overall prevalence of dry eye among patients of age 20 years and above was found to be 33.66%. Similar to this, a study conducted in Korea reported a prevalence of 33.2%.[10] Whereas, study conducted by Shah and Jani. observed the prevalence of DED as 54.3%.[11]

Maximum prevalence (43.88%) of dry eye seen in this study was in the age group of 40–49 years followed by 40.76% in age group of 30–39 years. A cross-sectional study in Jordan found a high association of dry eye symptoms in subjects with age >45 years.[12] Whereas, another study done in the year 2005 observed significantly higher prevalence of dry eye (36%) in the older age groups (>70 years), as compared to all other age groups.[13]

In our study, the dry eye was more prevalent among female (38.65%) than among males (27.73%). Similarly, female preponderance has been reported in the study done by Sahai and Malik.[13] However, a study done by Titiyal *et al.* in North India and a study done by Tseng *et al.* reported higher prevalence of dry eye in males than females.[14,15]

About 69% of our study population was from urban area, prevalence of dry eye was found to be more in urban patients (41.06%) than patients from rural area (17.20%). Similarly, more preponderance of dry eye among urban subjects was seen in a population-based dry eye study done by Lee *et al.*[16]

We found the highest prevalence of dry eye among computer operators and students (68.18% and 54.16%, respectively). This may be due to exposure to computers/mobiles screens as well as air conditioners at the same time. We also observed that maximum prevalence of DED in subjects with VDT use for more than 6 h (63.9%), followed by 2–6 h (62.7%) and <2 h (43.1%). A study done in 2005 also found higher prevalence of dry eye in computer users.[13] Another study done in North India reported that 89.98% of patients with 4 h or more of VDT usage were associated with severe dry

eye.[14] Thus, use of television, mobile phones, computers, and laptops for hours was observed to have a significant correlation with DED. This emphasizes the need for creating awareness among the students and computer users to adopt preventive measures.

About 31% of our study population consists of drives, farmers, and laborers, the prevalence of dry eye among them was 38.46%, 33.33%, and 35.71%, respectively. Khurana *et al*. too reported the prevalence of dry eye of 32% among farmers and 28% among laborers. This was probably due to their prolong exposure to excessive heat, sunlight, and dust.[17] In year 2015, a hospital-based study in South-east China also observed exposure to adverse environment as a risk factor for DED.[18] In contrast to our findings, a study conducted in 2010 reported that occupation had no effect on the risk of dry eye ($P = 0.952$).[3]

We found prevalence of dry eye of 75% among the patients of connective tissue disease. Among 28 patients who were having thyroid disorder, dry eye was found in 60.7%. Similarly, a study conducted by Shah and Jani and another study conducted by Galor *et al*. in United States observed higher risk of dry eye in patients of connective tissue disease and in patients of thyroid disorder in.[11,19] We found 42.1% prevalence of dry eye among the diabetic patients. This is consistent with a study conducted by Manaviat, who found the prevalence of 54.3% of dry eye among the patients of Type 2 diabetes.[20] In the present study, the prevalence of dry eye among patients on topical anti-glaucoma medication was eighty percent. This was consistent with the study conducted by Shah and Jani who also found the prevalence of dry eye of 72% among patients on topical anti-glaucoma medication.[11]

In the present study, the prevalence of dry eye among contact lens users was 62.5%. A study conducted in Japan in year 2011, Beaver Dam Offspring Study in 2014 and a study in Jordan 2016 also found contact lens use a risk factor for DED.[9,19,12] The prevalence of dry eye was 78.1% in patients with history of refractive surgery and 57.89% among the smokers in this study. A study conducted by Shah and Jani in Gujrat also found 60.4% prevalence of dry eye among patients with history of intraocular surgery and 60% prevalence of dry eye among smokers.[11]

Limitations

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

CONCLUSIONS

High (33.66%) prevalence of DED in our study reflects it as a major burden among routine outpatients. Risk factors precipitating or worsening the DED include VDT use, contact lens use,outdoor occupations like farmers, laborer and drivers, connective tissue disease, thyroid disorder, diabetes mellitus, use of topical anti-glaucoma drugs, refractive surgery, and smoking. These contributing factors need to be emphasized for a more systematic targeted and effective approach toward DED. Identification of these factors not only would decrease ocular health burden but also minimize huge economic burden on the society.

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