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Dry Eye - Study of Prevalence, Attributed Risk Factors and Frequency of Symptoms in an Urban Population

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Abstract

The term dry-eye syndrome according to DEWS has been defined as "a multifactorial disease of the tears and ocular surface with various aetiologies that results in symptoms of discomfort, visual disturbance, and tear-film instability with potential damage to the ocular surface. The ocular surface disease index (OSDI) questionnaire was explained to the section of patients belonging to Kamrup Metro district of Assam and they had to undergo dry eye parameters to diagnose dry eye. The diagnosis was confirmed when at least three of the tests yielded positive results. In this cross-sectional study prevalence of dry eye was found to be 39% in Kamrup Metro district, with 195 patients having dry eye disease. Of those, 90 (46.15%) patients had mild DED, 58 (29.74%) had moderate DED and 47 (24.10%) had severe DED. The most common type is evaporation 40.4%, with females being more affected than males. Bank employees are most prone to dry eye due to digital screen use (51.47%)., with risk factors including female sex, digital screen use, smoking, and air-conditioned environments. The study confirms a higher prevalence of dry eye disease in females compared to males, possibly due to hormonal influences, smoking, exposure to irritants, and prolonged screen time. It also highlights workplace factors like prolonged screen time and air conditioner use. It calls for education on preventive measures.

Keywords: *Dry eye syndrome, Ocular surface disease index, Dry eye symptoms, DEWS*

1 Introduction

Dry eye disease (DED) is a multifactorial ocular morbidity that can lead to discomfort, visual disturbance, instability of tear film. It may also cause damage to the surface of the eyes and inflammation, resulting in increased osmolarity of tears(1). DED can be characterized as episodic or chronic. Episodic dry eye occurs when reduced blinking tasks overwhelm tear stability, causing symptomatic dry eye. Though the same environmental factors make chronic dry eye worse, it continues to have symptoms and may even harm the ocular surface(2). Dry eye patients experience symptoms such as stinging or burning sensation, grittiness, foreign body sensation, excessive tearing, ocular fatigue, and dryness due to unstable tear film(3; 4). Based on the severity, the symptoms can be disabling and affect a person's quality of life and productivity at work(5). Dry eye disease (DED) is a growing cause of ocular morbidity and is a frequent issue that prompts patients to seek eye care(6). With an aging population, the increased usage of screens, along with environmental changes, is only likely to increase(7). Dry eye disease is more prevalent in patients with autoimmune diseases(8) affecting 78% of women(9). Dry eye disease affects postmenopausal women and the elderly. Prevalence of DED ranges from 7.4% to 33.7% (10; 11) depending on which study is referenced, how the disease is identified and which group of the population is surveyed. Beaver Dam study reveals 14% DED prevalence in adults aged 48-91, with women more affected than men (16.7% versus 11.4%, respectively) (12). The knowledge of the pathophysiology and etiology of DED has significantly improved during the past ten years. The understanding of Dry Eye Disease (DED) has improved by recognizing the distinct components of the disease - tear evaporation and insufficient tear production - and their respective roles (13). Tear film instability, lipid layer thickness, and inflammation's role in DED are identified as common features in various stages (14) aiding in understanding and treating the condition. According

to studies, DED significantly impacts patients' visual function, social and physical well-being, daily activities, work performance, and quality of life (QOL) (15; 16). Very few studies of dry eye prevalence with associated risk factors are being conducted in the Northeast region. So, understanding its prevalence and risk factors will be crucial for public health efforts to prevent and manage this condition. Regional factors will also play a crucial role as climate, air pollution, and lifestyle can significantly influence the prevalence of dry eye. This study can provide tailored insights for this specific location. The findings can be valuable for local healthcare authorities and practitioners to allocate resources, develop prevention strategies, and provide targeted treatment options to residents. Limitation of the present study was that patients with severe corneal/conjunctival pathology were excluded. This may have led to an underestimation of dry eye prevalence, as performing tests in these cases would have been challenging. It is also noted that the dry eye prevalence is usually expected to be higher in contact lens users, who were excluded in this study. The study group included only the urban population. There's a need for longitudinal studies that track dry eye prevalence and risk factors in Guwahati over time. This would provide a more comprehensive understanding of how the condition is evolving. This study aimed to determine the prevalence of dry eye, its attributable risk factors and the frequency of symptoms among patients aged above 20 years in a Kamrup metropolitan district in an ophthalmology outpatient clinic.

2 Material and Methods

This was a cross-sectional study conducted from July 2022 to June 2023. With systematic random sampling, inclusion of 500 patients out of which 220 were males and 280 females in the age group of 20 - 80 years of age were selected and were informed about the nature of the study.

1. **Inclusion criteria:** for this study encompassed individuals aged 20 years and above who presented with two or more of the following symptoms: grittiness, redness, eye irritation, eye dryness, excessive tearing, eye itching, foreign body sensation, and photophobia.

2. **Exclusion criteria** : for this study involved patients who exhibited any of the following conditions: contact lens use, a history of ocular surgery, infectious or allergic conjunctivitis, structural abnormalities in one or both eyelids, a history of Stevens-Johnson syndrome, alterations in the lacrimal drainage system, and previous exposure to chemical, thermal, or radiation injuries.

The ocular surface disease index questionnaire was prepared which was explained to the patient and the ocular surface disease index score was calculated. Each patient underwent a detailed evaluation of the dry eye, including the anterior segment evaluation, Ocular Surface Disease Index (OSDI) questionnaire, Lissamine Green test, Tear film break-up time (TBUT), Schirmers test and presence of strands/filaments.

3 Dry Eye Parameters

3.1 OSDI Questionnaire

Allergan's OSDI test is a widely used questionnaire to assess various aspects of ocular surface disease, consisting of 12 questions divided into three parts: ocular pain, visual functionality, and environmental factors. Questions 1 to 5 discuss ocular discomfort or visual problems like blurriness or light sensitivity; questions 6 to 9 discuss visual functioning and the ability to read or drive at night; and questions 10 to 12 examine environmental issues like air conditioning or wind. The score ranges from 0 to 100 and the responses are 0 to 4, with 0 denoting never and 4 denoting always (17).

3.2 Lissamine Green Test

Lissamine green dye, a non-fluorescent greenish-blue color, is commonly used for conjunctival staining due to its less discomfort compared to Rose Bengal. It is typically instilled at a concentration of 1% with a drop of 25l (18; 19). The Oxford Schema recommends using a 25l drop without prior anaesthesia (20) and observing the staining with a slit lamp biomicroscope using either white light, which results in a blue-green stain, or an intensifying red barrier filter, which results in a black appearance to the staining pattern. Lissamine green is widely accepted to penetrate membrane-damaged conjunctival cells to stain the nucleus (21).

3.3 Tear Film Break-Up Time

The tear break-up test is a standard clinic test for assessing tear film stability (22; 23), revealing that fluorescein shortens the normal break-up time. It is most effectively observed using a blue exciter and a yellow barrier filter, with the patient refraining from blinking. The yellow filter is optional, though. The break-up time is the interval between the last blink and when a dark spot first appears on the fluorescein-stained film. The break-up time varies between individuals and at different times of the day. A break-up time of less than 10 seconds indicates an unstable tear film, and it is reduced in all forms of dry eye (24).

3.4 Schirmer 1

The Whatmann strip was placed between the intersection of the middle and outer third of the lower lid for the Schirmer I test, which measures both basal and reflex secretion. The same procedure was repeated for the other eye. The strip was removed after 5 minutes and the length of the strip wetting was measured in millimeters. A Schirmer's I test value of less than 5 mm is generally considered abnormal (25). Dryness has been defined as less than 15mm in 5 minutes, while mild, moderate, and severe dryness have been defined as 15-10mm, 10mm-5mm, and 5mm, respectively (26).

3.5 Ophthalmologic Evaluation

Following the acquisition of informed written consent, a comprehensive patient history was obtained and a thorough ophthalmologic assessment, including best-corrected visual

acuity, was conducted. Each individual underwent an extensive evaluation to assess for indicators of dry eye. This included the anterior segment examination, slit-lamp examination of the lid margin, the Ocular Surface Disease Index (OSDI), Lissamine Green test, Schirmer 1 test, tear film break-up time (TBUT) and presence of strands/filaments.

4 Results

In the present study out of 500 patients, 195 patients had Dry eye disease. The prevalence of dry eye in Kamrup Metro is 39%. Of those, 90(46.15%) patients had mild DED, 58(29.74%) had moderate DED and 47 (24.10%) had severe DED. Age-wise distribution was shown in Table 1, where the maximally affected age group was around 60-69 years. The distribution of dry eye types, as presented in Table 2, showed that the evaporation type was the most common, accounting for 40.4%, followed by the mixed type at 33%. Analyzing the sex distribution in Table 3, it was evident that females (42.14%) were more susceptible to DED than males (35%). Dry eye symptoms of patients are shown in Table 4, where the most common symptom was found to be a gritty feeling (45.12%) followed by red eyes (39.48%) in the eye. Dry eye distribution according to occupation reveals that bank employees are the most prone to dry eye due to their exposure to digital screen use (51.47%) (Table 5). This finding shows a high level of statistical significance (p-value = 0.001). Lastly, Table 6 outlined the distribution of DED based on risk factors, but none of the included factors were found to have statistical significance in contributing to the development of DED.

5 Discussion

In India, the prevalence of dry eyes ranges from 18.4% to 54.3% (22; 27). Previous study indicates that the prevalence of dry eye disease varies significantly, with rates ranging from 10.8% to 57.1% (28). The vast disparity in dry eye prevalence is because different dry eye diagnostic criteria are employed along with different cut-off values for objective dry eye tests. Another reason is the geographical location of the study population. The dry eye prevalence of our study was 39% which falls within the above range. Other studies have also reported a higher prevalence of DED (29; 30). In this study (31), predominant type of dry eye was evaporative dry eye (45.12%) followed by the mixed pattern (31.79 %) and also predominance of evaporative dry eye followed by aqueous deficient dry eye and mixed type. The effect of meibomian gland dysfunction in almost all age groups could be the reason for evaporating exceeding the aqueous deficient type (32; 33). This study found a gradual increase in the prevalence of dry eye with advancing age, which aligns with similar observations from other studies on dry eye (12; 34). This trend can be explained by the fact that with increasing age there is an increase in lacrimal gland ductal pathology that could promote lacrimal gland dysfunction by its obstructive effect, also there is a decrease in androgen levels (35; 36). Studies generally indicate a higher prevalence of dry eye disease in females compared to males (28; 32; 33). In the present study too, 42.14% of females had dry eye compared to 35% of males and the difference was statistically significant (P =0.024). This is because hormonal influences in the pathogenesis of dry eye (28; 37) have a greater bearing on females than males. Numerous studies have found that sex hormone levels can impact the functioning of both the lacrimal and meibomian glands (38; 39; 40). Additionally, factors such as smoking, air pollution, and certain medications have been identified as potential risk factors in multiple research studies (12; 28; 41). Cigarette smoking increases the risk of tear film instability through direct irritation to the eyes, making it a modifiable factor that contributes to dry eye development. In our study, the prevalence of dry eye in smokers was 32%. Considerable prevalence among the young involved in office work could be due to increased screen viewing time which reduces blinking rate(42; 43) and exposure to air conditioners for long hours. Bank employees (51.47%) in this study, had a high prevalence of dry eyes which was statistically significant. In this study, 25.8% of the patients had a history of systemic disease. The most commonly encountered diseases were Diabetes and Hypertension. The study found no significant statistical correlation between diabetes mellitus and hypertension. The most frequent symptom encountered was grittiness (45.12%) followed by redness (39.48%) of the eyes. In a majority of the previous studies, symptoms of ocular irritation (burning sensation, grittiness, and redness) were also more commonly reported than actual dry eyes(44; 45; 46) . In a study (44) it was also found that the most frequently reported symptom of dry eye disease was a burning sensation, followed by sensations of grittiness and redness.

6 Conclusion

This study confirms the higher prevalence of dry eye disease in females compared to males, consistent with previous research findings. Dry eye symptoms in both genders may be influenced by hormonal influences, smoking, exposure to irritants like air pollution, and prolonged screen time. Workplace factors, such as prolonged screen time and air conditioner use, may also contribute to the development of dry eye disease among office workers.

Table 1: Age Distribution of the Patients

Age (in years)	No. of subjects	Subjects with dry eye	Prevalence (%)
20-29	68	17	25
30-39	97	31	31.95
40-49	99	39	39.39
50-59	100	42	42
60-69	111	58	52.25
70-80	25	8	32

Table 2: Dry Eye Distribution According to Type

Type	Number of patients	Prevalence (%)
Evaporative	88	45.13
Aqueous deficient	45	23.08
Mixed	62	31.79
Total	195	100.00

Table 3: Sex Distribution

Gender	Number of Patients	Patients With Dry Eye	Prevalence (%)
Male	220	77	35
Female	280	118	42.14
Total	500	195	

Table 4: Dry Eye Symptomatology of Patients

Symptoms	Number of Patients (N=195)	Prevalence (%)
Grittiness	88	45.12
Redness	77	39.48
Itching	63	32.3
Burning	54	27.69
Irritation	46	23.58
Dryness	40	20.51
Foreign body sensation	35	17.94
Tearing	30	15.38

Table 5: Dry Eye Symptomatology of Patients

Risk Factors	Exposed	Affected	Prevalence (%)
Smoking	50	16	32
Air conditioning	70	20	28.57
Systemic diseases	93	26	25.8
Topical medications	35	10	28.57
Systemic medications	88	28	31.81

Conflict of Interest

The authors declare no conflict of interest in this reported communication.

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