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Dry Eye Disease- Clinical Burden, Risk Profile, And Treatment Patterns

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Abstract:
Background*: Dry eye disease prevalence is a multifactorial disorder with symptoms of redness, irritation, photophobia. Pathophysiology of dry eye disease is influenced by large range of factors including environmental, hormonal systemic and topical medications. In this study efforts have been made to increase awareness about this condition using early diagnostic tools.*
Materials and Methods*: In this prospective observational study, 125 patients recruited consecutively based on clinical presentation. Subjective assessment of dry eye symptoms was performed using the Ocular Surface Disease Index (OSDI) questionnaire consisting of 12 items divided into three domains: ocular symptoms (Section A), functional limitations (Section B), and environmental triggers (Section C). The total score was used to categorize disease severity: normal (0–12), mild (13–22), moderate (23–32), and severe (33–100). Objective clinical testing included Schirmer's tests I and II, corneal fluorescein staining (CFS), Rose Bengal staining, and Tear Film Break-Up Time (TBUT). Demographic data and relevant clinical history were recorded, including age, gender, occupational exposure (especially screen time), systemic illnesses, history of allergy, medication use (ocular and systemic), and prior ocular interventions. These factors were collected to assess potential associations or risk factors related to dry eye.*
Results*: Overall, the current study confirms a high prevalence of dry eye syndrome among patients attending our ophthalmology department particularly among older females (p<0.05).*
Conclusion: *This study reveals a high prevalence of dry eye disease (DED) among the study population underscoring the need for greater awareness, early diagnosis and individualized treatment strategies for DED, particularly in populations with chronic systemic diseases.*
Key Word: *Dry eyes, Risk profile, Early diagnosis*

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I. Introduction

Dry eye disease (DED) is a prevalent, multifactorial disorder of the ocular surface characterized by a loss of tear film homeostasis. Its symptoms—ranging from dryness, irritation, and foreign body sensation to fluctuating vision and photophobia—can significantly impair visual function and daily comfort. Globally, the reported prevalence of DED varies widely, from 5% to over 50%, depending on diagnostic criteria, demographic factors, and geographical region. [1, 2]. The pathophysiology of DED is complex and influenced by a range of factors including environmental exposure, hormonal fluctuations, systemic medications, refractive or cataract surgeries, and alterations in blink rate or meibomian gland function. [1, 2]

The disease not only compromises ocular health but also diminishes quality of life and day to day normal working. Chronic inflammation, tear hyperosmolarity, and neurosensory abnormalities can contribute to disease progression, potentially leading to complications such as corneal thinning, vascularization, scarring, or even perforation in advanced cases.[3,4] Moreover, the psychological burden of persistent ocular discomfort is increasingly recognized, with numerous studies linking DED to depression, anxiety, and post-traumatic stress disorder (PTSD), particularly in those with moderate to severe symptoms. Up to 29% of individuals with depression may suffer from DED. [5]

In light of these concerns, the present study aims to assess the prevalence of dry eye disease among patients attending the ophthalmology outpatient department in a tertiary care center. By doing so, the study seeks to bridge gaps in epidemiological data, especially in settings where local environmental, occupational, and lifestyle factors may alter disease patterns. Additionally, this investigation intends to identify various risk factors contributing to DED, including age, sex, contact lens wear, screen time, systemic illnesses, and post-ocular surgical status.

Understanding these risk factors is crucial, as failure to recognize and address them can result in misdiagnosis, treatment delays, increased financial burden, and further compromise in patient outcomes. Therefore, the study also seeks to improve quality of life by facilitating early detection and timely management of DED, especially among high-risk groups. Identification of modifiable contributors can guide targeted interventions and preventive strategies in clinical practice.

Epidemiological studies, including those reviewed in DEWS II, have confirmed significant variability in prevalence estimates across populations. Women over the age of 50, individuals with autoimmune conditions, and video display terminal (VDT) workers are especially susceptible.[5-8] In fact, studies among office workers and computer users have reported dry eye symptoms in up to 72% of individuals based on OSDI scoring. Despite this growing awareness, regional data—particularly from Nordic countries and parts of Asia—remain limited. This study will therefore contribute valuable insights into the regional burden, symptom profile, and contributory risk factors for DED, thereby supporting improved patient care and resource allocation.

II. Material And Methods

This prospective observational study was conducted in the Outpatient Department of Ophthalmology at a tertiary care center over a 24-month period, from February 2023 to January 2025. The study included 125 patients above 10 years of age recruited consecutively based on clinical presentation.

Study Design: Prospective observational study

Study Location: This study was conducted in the Outpatient Department of Ophthalmology at a tertiary care center.

Study Duration: February 2023 to January 2025.

Sample size: 125 patients.

Sample size calculation: According to previous medical records, approximately10-15 patients of Dry eyes visit Tertiary care center in a month. As per given data ,125 patients are enrolled in this study.

Subjects & selection method: This prospective observational study aimed to evaluate the clinical profile and diagnostic patterns of Dry Eye Disease (DED) in patients presenting with suggestive symptoms. Each participant underwent a comprehensive ophthalmologic evaluation. Subjective assessment of dry eye symptoms was performed using the Ocular Surface Disease Index (OSDI) questionnaire. This validated instrument consists of 12 items divided into three domains: ocular symptoms (Section A), functional limitations (Section B), and environmental triggers (Section C). Responses were recorded using a 5-point Likert scale ranging from 0 (none of the time) to 4 (all of the time). The total score was used to categorize disease severity: normal (0–12), mild (13–22), moderate (23–32), and severe (33–100). Objective clinical testing included Schirmer's tests I and II, corneal fluorescein staining (CFS), Rose Bengal staining, and Tear Film Break-Up Time (TBUT). Demographic data and relevant clinical history were recorded, including age, gender, occupational exposure (especially screen time), systemic illnesses, history of allergy, medication use (ocular and systemic), and prior ocular interventions. These factors were collected to assess potential associations or risk factors related to dry eye. All patient data were de-identified to maintain confidentiality.

Inclusion criteria:
1.Individuals above 10 years of age who reported symptoms such as ocular discomfort, photophobia, grittiness, or fluctuating vision.

Exclusion criteria:
1.If they had a recent history of ocular surgery within one month
2.The presence of a foreign body, or any ocular trauma

Procedure methodology

Following informed consent, each participant underwent a comprehensive ophthalmologic evaluation. Subjective assessment of dry eye symptoms was performed using the Ocular Surface Disease Index (OSDI) questionnaire. This validated instrument consists of 12 items divided into three domains: ocular symptoms (Section A), functional limitations (Section B), and environmental triggers (Section C). Responses were recorded using a 5-point Likert scale ranging from 0 (none of the time) to 4 (all of the time). The OSDI score was computed using the formula: OSDI = [(sum of scores for all answered questions) × 100] / [(total number of questions answered) × 4].

The total score was used to categorize disease severity: normal (0–12), mild (13–22), moderate (23–32), and severe (33–100). Despite its wide use, the OSDI may be subject to recall bias and individual variability in symptom perception, which should be acknowledged when interpreting results.

Objective clinical testing included Schirmer's tests I and II, corneal fluorescein staining (CFS), Rose Bengal staining, and Tear Film Break-Up Time (TBUT). Schirmer's test without anesthesia was used to assess total tear secretion, whereas the anesthetized variant measured basal tear production. Filter paper strips were placed in the lower fornix for 5 minutes, and the length of wetting was recorded in millimeters. Values <15 mm (without anesthesia) or <10 mm (with anesthesia) were considered indicative of tear deficiency. While Schirmer's test is widely used, its accuracy may vary with environmental factors and patient cooperation, introducing potential measurement bias.

Corneal fluorescein staining was performed by instilling fluorescein dye into the lower fornix. Patients were instructed to blink several times for even distribution, and staining patterns were assessed under cobalt blue light. Scores were assigned based on the number and distribution of punctate epithelial erosions. Rose Bengal staining was used to highlight devitalized epithelial cells and mucin-deficient areas, providing additional diagnostic value. However, due to its cytotoxic nature and associated discomfort, topical anesthesia was used before its instillation to improve tolerability and compliance.

Tear Film Break-Up Time (TBUT) was measured by instilling fluorescein dye and observing the tear film under cobalt blue light using a slit lamp. Patients were instructed to blink once and then refrain from blinking. The interval between the last blink and the appearance of the first dry spot was recorded. A TBUT of >10 seconds was considered normal; values between 5–10 seconds were borderline, and <5 seconds were abnormal. Although TBUT is an important measure of tear film stability, it is inherently subjective and dependent on examiner expertise and patient cooperation, which may contribute to interobserver variability.

Demographic data and relevant clinical history were recorded, including age, gender, occupational exposure (especially screen time), systemic illnesses, history of allergy, medication use (ocular and systemic), and prior ocular interventions. These factors were collected to assess potential associations or risk factors related to dry eye. All patient data were de-identified to maintain confidentiality.

All procedures involved in this study are part of routine clinical evaluation for DED and were performed without incurring any additional cost to the patients. As such, no funding was required or utilized for the study.

Statistical analysis

Data were entered in Microsoft Excel and analyzed using standard statistical methods. Descriptive statistics were used to present frequencies, percentages, means, and standard deviations. Quantitative variables were compared using the Student's t-test, while categorical variables were analyzed using the Chi-square test. A p-value of <0.05 was considered statistically significant.

Efforts were made to standardize all testing procedures and minimize observer-related variability by ensuring that a single trained ophthalmologist performed all clinical evaluations. However, some residual observer bias and patient-level variability (e.g., symptom exaggeration, misunderstanding of questionnaire items) cannot be fully excluded. Additionally, environmental conditions such as humidity and airflow were not controlled and may have influenced test results like TBUT or Schirmer's values. While the lack of a control group limits causality assessment, the observational design was suitable for exploring the clinical spectrum and burden of DED in the real-world outpatient setting.

III. Result

The demographic profile of the study included 125 participants aged between 18 and 78 years, with a mean age of 54.5 years and a standard deviation of 15.5 years. The majority of the participants were within the 31–50 years (40.8%) and 51–70 years (38.4%) age groups, collectively comprising 79.2% of the total sample. Participants aged 11–30 years accounted for 14.4%, while those above 71 years represented only 4.8%, indicating a predominance of middle to late adulthood in the study population (Table 1). There was a marked gender disparity, with females constituting 73% of the cohort and males comprising 25% (n=32), underscoring the female preponderance in this study sample (Table 1). .

Table 1: Demographics and Risk Factors

Variable	Category	Percentage (%)	Number (n)
Age Group (years)	11–30	14.4	
	31–50	40.8	
	51–70	38.4	
	>70	4.8	
Gender	Female	73	91
	Male	25	32
Risk Factors	Contact lens use	3	
	Screen time >4h/day	25	
	Regular medication use	30	
	Smoking	15	
	Autoimmune disease	25	
	Diabetes	30	
	Hypertension	69	
	Diabetes + Hypertension	60	
	Prior eye issues	5	

Assessment of potential risk factors revealed that 3% of participants used contact lenses, while 25% reported screen time exceeding 4 hours per day (Table 2). Regular medication usage was noted in 30% of participants, and 15% were identified as smokers (Table 2). Autoimmune diseases were reported in 25% of the study population (Table 2). Diabetes was present in 30% of participants, and hypertension in 69% (Table 2). Notably, 60% of the population had both diabetes and hypertension, highlighting a high prevalence of comorbid chronic conditions. Only 5% reported having prior eye issues.

Table 2: Diagnostic and Symptom Assessment

Test/Symptom Category	Subcategory	Percentage (%)
Schirmer's Test	Positive	60
	Negative	40
TBUT (<10s Abnormal)	Positive	64.8
Ocular Surface Staining	Positive	50
	Negative	50
Meibomian Gland Dysfunction	Dysfunction Present	26.67
	Normal Glands	73.33
OSDI Severity	Normal (0–12)	8.0
	Mild (13–22)	11.2
	Moderate (23–32)	16.0
	Severe (33–100)	64.8
OSDI-Based Dry Eye Presence	Dry Eye Symptoms Present	92.0

Regarding therapeutic measures, artificial tears were the most commonly used treatment, reported by 71% of the participants, with 70% of these users finding them effective. Prescription medications like oral

tetracyclines were used by 40% of patients with co-existing pathologies like meibomitis and blepharitis, and 74% of those found them effective (Table 3). Warm compresses and lifestyle changes were each used by 45% of participants, with reported effectiveness of 75% and 55%, respectively (Table 3). Punctal plugs were the least utilized intervention, used by only 15%, but demonstrated the highest effectiveness at 80% (Table 3). These findings suggest that although punctal plugs are not frequently employed, they are perceived as highly effective by users.

Table 3: Therapeutic Measures and Effectiveness

Therapy Type	Used by (%)	Found Effective by (%)
Artificial Tears	71	70
Prescription Medications	40	74
Warm Compresses	45	75
Lifestyle Changes	45	55
Punctal Plugs	15	80

Evaluation of diagnostic tests revealed that Schirmer's test was positive in 60% of cases and negative in 40%, indicating a substantial prevalence of tear production deficiency. Tear Break-Up Time (TBUT) testing yielded positive results in 64.8% of participants, further suggesting tear film instability. Ocular surface staining showed an even distribution, with 50% each for positive and negative results. Together, these diagnostic modalities suggest a consistent trend toward identifying dry eye conditions in a significant portion of the sample.

Symptomatically, the Ocular Surface Disease Index (OSDI) responses indicated that 64.8% of participants experienced severe dry eye symptoms (OSDI score 33–100), while 16% had moderate symptoms (score 23–32), and 11.2% reported mild symptoms (score 13–22) (Table 4). Only 8% had normal scores (0–12). This suggests a high burden of subjective dry eye symptoms among the population studied. Meibomian gland dysfunction was observed in 26.67% of participants, while 73.33% had normal gland function, indicating that evaporative dry eye due to gland dysfunction affected a minority.

Table 4: Symptom Details and Functional Impact (OSDI)

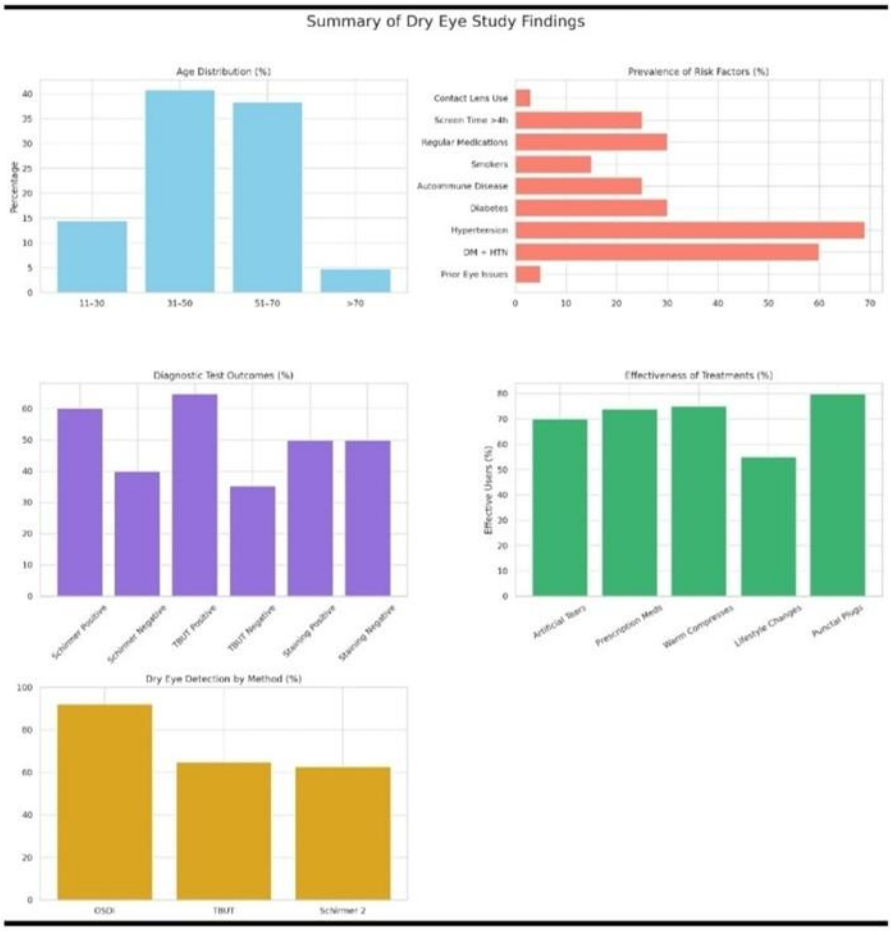
Category	All the Time (%)	Most of the Time (%)	None/Some of the Time (%)
Symptoms			
Gritty eyes	10	22	68
Photophobia	23	24	53
Blurred vision	23	37	40
Poor vision	27	39	34
Sore/Painful eyes			55
Functional Limitations			
Difficulty reading	64	10	26
Computer use	0	0	77
Watching television	0	0	47
Night driving	14	31	55
Environmental Discomfort			
Windy conditions	18	21	61
Air-conditioned environments	15	10	75

Dry/low-humidity environments	0	0	74

Analysis of specific ocular complaints from the OSDI questionnaire revealed that gritty eyes were experienced all the time by 10% and most of the time by 22% of participants, with 40% reporting symptoms some of the time. Photophobia was experienced all the time by 23% and most of the time by 24%, indicating a frequent occurrence of light sensitivity. Blurred vision and poor vision were commonly reported, with 23% and 27% experiencing them all the time, and 37% and 39% most of the time, respectively. In contrast, sore and painful eyes were less frequently reported, with 55% stating they did not experience this symptom.

When evaluating functional limitations, 64% reported that their eyes were limited all the time while reading, while 10% reported limitations most of the time. A majority (77%) did not experience visual limitations while working with a computer, and nearly half (47%) reported no difficulties while watching television. Driving at night posed challenges for some participants, with 14% experiencing visual limitations all the time and 31% most of the time. Environmental discomfort was also prevalent; 18% experienced eye discomfort all the time in windy conditions, while 21% experienced it most of the time. Discomfort in air-conditioned environments was reported all the time by 15% and most of the time by 10%. However, discomfort in low-humidity or very dry environments was less common, with 74% reporting no symptoms. Further objective assessment revealed that TBUT was abnormal (<10 seconds) in 64.8% of the population, indicating a high prevalence of tear film instability. The Schirmer 2 test showed that 45.6% of participants had tear production consistent with dry eye and lacrimal insufficiency (5–9 mm), and 17.6% had true dry eye (<5 mm). Only 38% of the population had normal tear production (≥10 mm). Altogether, dry eye syndrome was identified in 62.67% of the population via the Schirmer 2 test, and in 64.67% through TBUT, whereas 92% demonstrated symptoms consistent with dry eye via the OSDI questionnaire. These findings confirm a high prevalence of both symptomatic and objectively measured dry eye in the study population.

Figure1: Demonstrates a summary of the findings of our study**.**



IV. Discussion

The present study aimed to determine the prevalence and severity of dry eye syndrome among patients attending the ophthalmology department using three primary methods: the Ocular Surface Disease Index (OSDI) questionnaire, Tear Break-Up Time (TBUT), and Schirmer 2 test. The participants ranged from 18 to 78 years of age, with a mean age of 54.5 years, and there was a higher representation of females than males. Most participants fell within the 31–50 years age group, followed by the 51–70 age group. These findings were in concordance with certain previous studies, all of which reported a greater female prevalence and higher representation of middle-aged and elderly populations.[9-11] However, the study by Jeewan Singh Titiyal et al. (2018) reported more male participants and a younger peak age group.[12] Bhatt et al. (2023) also highlighted age-related variations in prevalence, showing the highest rates among the elderly and a higher prevalence in males, a finding not consistent with most literature which typically shows female predominance.[13] The influence of urban versus rural residency was also noted, with urban populations showing a significantly higher prevalence.

Several risk factors were identified in the current study. These included contact lens use (28%), prolonged screen time over four hours daily (65%), presence of chronic illness or maintenance needs (30%), smoking (20%), and autoimmune diseases (15%). The association of older age and female gender with dry eye was supported by earlier works, with hormonal changes such as estrogen deficiency post-menopause being implicated in women.[14-16] While most studies, including the present one, find a higher prevalence in females, Ranjan et al. (2016) found a male predominance in rural populations due to increased environmental exposure.[17] Notably, smoking, a known irritant to the ocular surface, was more commonly reported by male participants, although not conclusively linked to DES in this study. Comparisons with international data, such as from Eastern Cape, revealed different contact lens usage patterns due to regional preferences in vision correction. Medication usage, another critical factor, varied in terms of type and prevalence. Kamal et al. found high usage of antihypertensives and diabetes medications, which are known to contribute to dry eye, and Colligris et al. (2014) identified specific medications with strong associations to DES.[18,19] The role of hormone replacement therapy, while not directly studied, was suggested as a potentially significant factor in female participants. Other studies, such as those from Saudi Arabia and Egypt, supported the association between systemic illnesses and dry eye, especially in populations over 40 years.

Assessment of dry eye severity and prevalence using the OSDI questionnaire revealed that 92% of participants experienced dry eyes, with 64.8% reporting severe symptoms. This figure is substantially higher compared to the 59% prevalence found by Bakkar et al. (2016) in Jordan and 64% reported in a South African university-based study, though both studies confirmed a high burden of disease.[20] The current study's OSDI findings aligned with data from Saudi Arabia (Alhamyani et al., 2017), which also showed a high prevalence of severe dry eye symptoms, particularly in older patients likely affected by systemic conditions.[21] The OSDI remains a widely used tool for subjective assessment, although it may overestimate severity compared to objective tests.

The TBUT method showed a dry eye prevalence of 64.8%, with 38% of patients demonstrating TBUT values of less than five seconds and 26% between five and ten seconds, indicating compromised tear film stability. Comparisons with studies from Egypt and Bangkok demonstrated varied prevalence rates based on population demographics and sample sizes, yet reaffirmed TBUT as a valuable diagnostic tool.[23,24]

Using the Schirmer 2 test, dry eye prevalence was identified in 62.67% of participants, with this test specifically evaluating the integrity of the lacrimal secretory system. This finding is comparable to the results of Kamel (2017) in Egypt, which noted a significant correlation between dry eye severity and diabetes.[18] Other studies, such as that by Onua & Chukwuka (2017) in Nigeria, reported lower prevalence using the Schirmer test, potentially due to differing criteria and environmental exposures.[23] It is important to note that Schirmer 2, unlike Schirmer 1, involves topical anesthesia and better isolates basal tear secretion, making it a more specific tool for DES detection.

In terms of severity classification, the OSDI questionnaire indicated severe dry eye in 64.67% of participants, while TBUT results suggested a 38% prevalence of severe cases. The Schirmer 2 test indicated a lower rate of severe dry eye at 16.67%, suggesting that symptom-based evaluation (OSDI) may reflect greater perceived disease burden than that identified through objective measures. This discrepancy highlights the ongoing challenge in establishing a unified gold standard for grading dry eye severity, as noted by Baudouin et al. (2014).[24] The wide variation between subjective and objective indicators underlines the multifactorial nature of dry eye syndrome and the need for a multimodal assessment approach. Overall, the current study confirms a high prevalence of dry eye syndrome among patients attending our ophthalmology department particularly among older females, with symptom severity often exceeding that detected by clinical tests.

V. Conclusion

This study reveals a high prevalence of dry eye disease (DED) among the study population, with 92% reporting significant symptoms based on the OSDI and over 60% exhibiting objective evidence of dry eye through

Schirmer's test and TBUT. The condition predominantly affected middle-aged to elderly females, with systemic comorbidities such as diabetes and hypertension contributing to the risk profile. Despite the widespread use of artificial tears, punctal plugs—though less commonly used—were perceived as the most effective intervention. The findings underscore the need for greater awareness, early diagnosis using both subjective and objective tools, and individualized treatment strategies for DED, particularly in populations with chronic systemic diseases.

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