

Occurrence of Dry Eye Disease in Type 2 Diabetic Patients at a Tertiary Care Center in Maharashtra: A Prevalence Study

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Abstract:-

➤ Purpose:

To evaluate the prevalence and clinical characteristics of dry eye disease (DED) among individuals with type 2 diabetes in a community-based setting. Additionally, the study aimed to identify factors associated with the presence of DED in this population.

➤ Methods:

A total of 136 randomly selected patients diagnosed with type 2 diabetes participated in the study, undergoing comprehensive ophthalmic evaluations. These evaluations included corneal sensitivity testing, tear film break-up time (BUT) assessment, the Schirmer I test, and fundus photography. The severity of diabetic retinopathy (DR) was graded according to the International Severity Scale.

➤ Results:

Among the 136 subjects, 23 (17.1%) were diagnosed with DED. There were significant associations between DED and higher blood glucose levels ($P < 0.001$) as well as elevated glycosylated hemoglobin (HbA1c) levels ($P < 0.001$).

➤ Conclusions:

These findings highlight the importance of incorporating dry eye assessments into the routine screening protocol for diabetic patients. The observed prevalence of DED at 17.1% in this cohort is lower than the rates reported in other studies. Importantly, individuals with diabetes who have poorer metabolic control are at a higher risk of developing DED.

Keywords:- Dry Eye Disease, Type 2 Diabetic Patients, Glycosylated Hemoglobin.

I. INTRODUCTION

Diabetes mellitus (DM) significantly contributes to global morbidity and mortality. In India, the prevalence of DM has risen from 7.1% in 2009 to 8.9% in 2019, underscoring the escalating challenge presented by this condition¹. By 2025, it is estimated that diabetes will affect approximately 380 million people worldwide, posing a significant public health challenge for both developing and developed nations². In addition to its systemic effects, diabetes mellitus (DM) can lead to various eye complications, including diabetic retinopathy (DR), diabetic papillopathy, glaucoma, cataracts, and diseases affecting the ocular surface³. Individuals with diabetes have an elevated risk of developing dry eye disease (DED) due to factors such as peripheral neuropathy, dysfunction of the lacrimal glands, inflammatory responses, and systemic hyperosmolarity resulting from hyperglycemia⁴. Dry eye disease (DED) can lead to ocular discomfort, blurred vision, and in severe cases, blindness. It also significantly diminishes quality of life (QOL) by impairing physical, social, and psychological well-being, reducing daily activities, and affecting workplace productivity^{5,6}. This study aimed to assess the prevalence of dry eye disease (DED) in individuals with type 2 diabetes within a community-based population, highlighting the critical role of early diagnosis and management in preventing complications and preserving vision^{6,7}.

II. METHODS

This prospective observational study was conducted over a one-year period from April 2023 to March 2024 at the Department of Ophthalmology, Government Medical College and Hospital, Latur. The study involved 136 participants, all aged 35 or older, who had type 2 diabetes and were seen at the ophthalmology outpatient department (OPD). These individuals were selected based on the American Diabetes

Association (ADA) criteria for diagnosing type 2 diabetes. This selection ensured that the study focused on a specific and well-defined group of patients, providing reliable data on the prevalence of dry eye disease (DED) in this population. Exclusion criteria encompassed systemic diseases or local ocular surface abnormalities unrelated to diabetes, current use of anti-glaucoma medications, collagenous diseases like rheumatoid arthritis, chronic use of contact lenses, medications known to cause dry eyes, or previous ocular surgeries including LASIK.

Each consecutive eligible patient attending the OPD during the study period was enrolled after obtaining informed consent and ethical clearance. The study protocol involved a comprehensive assessment comprising detailed medical histories and routine ocular examinations. Key assessments included measurements of fasting and postprandial blood sugar levels, estimation of glycosylated hemoglobin (HbA1c), corneal sensitivity testing, tear film break-up time (BUT) testing, and Schirmer I test for tear production. Fundus photography was performed to grade diabetic retinopathy severity and assess diabetic macular edema using the International Severity Scale of Diabetic Retinopathy.

Dry Eye Disease (DED) diagnosis in this study relied on several clinical assessments. These included slit-lamp examination to evaluate the anterior segment of the eye, Schirmer’s test to measure tear production, tear film break-up time (BUT) to assess tear stability, and the Rose Bengal staining technique to detect ocular surface abnormalities. A comprehensive ocular examination involved assessing visual acuity with Snellen’s chart, examining the anterior segment under a slit lamp to observe the condition of eyelids,

conjunctiva, and cornea, and evaluating the tear film quality. Dry eye severity was graded based on Schirmer’s test results: mild if 6–10 mm of tear production in 5 minutes, moderate for 3–5 mm, and severe if ≤ 2 mm. Additionally, fundus examination was conducted using direct and indirect ophthalmoscopy with a +90 D lens to detect diabetic retinopathy and assess any associated retinopathic changes.

➤ *Statistical Analysis*

Data analysis employed standard statistical methods encompassing tabulation, calculation of proportions, percentages, means, and standard deviations. Statistical tests including the Chi-square test, t-test, and ANOVA were selected based on the nature of the variables analyzed. A significance level of $p < 0.05$ was used to determine statistical significance.

III. RESULTS

In this study, we enrolled 136 diabetic patients from the outpatient department, with an average age of 52.26 ± 9.06 years. The largest proportion of patients (45%) belonged to the 40-50 years age group, and females constituted the majority (54%) of the study population. Among these patients, 59% were diagnosed with dry eye disease, and their average duration of diabetes was 5.19 ± 3.80 years (Table 1). We found a statistically significant difference in dry eye prevalence between male and female patients ($p = 0.001$). The most commonly positive diagnostic test for dry eye was tear film break-up time (32%), followed by Schirmer’s test (22%) and Rose Bengal staining (20%). Additionally, a substantial number of patients (40%) exhibited visual acuity ranging from 6/24 to 6/60.

Table 1 Association of Dry Eyes with Mean Duration of Diabetes

Diagnostic Test	Number of Patients (n)	Duration in Years (Mean ± SD)
Positive	23	5.19±3.80
Negative	113	2.07±6.57

Table 2 Distribution of the Type 2 Diabetes Patients According to their Dry Eye Characteristics (n=100)

Positivity	% of Dry Eye Patients
Dry eye	
Absent	113
Present	17.1
Mild	09
moderate	06
Severe	02

IV. DISCUSSION

Dry eye occurs when the tear film lacks adequate moisture, leading to either insufficient tear production or excessive evaporation. This imbalance harms the eye's surface, leading to symptoms like ocular discomfort.⁸ Dry eye syndrome (DES) is common, affecting around 28% of adults. People with DES frequently endure discomforts such as a burning sensation, feeling like something is in their eye, stickiness, excessive tearing, redness, and blurred vision. These symptoms can potentially lead to complications in the eye, such as keratoepitheliopathy and keratitis.^{9 10} Effectively managing

symptoms and preventing damage to the ocular surface are crucial aspects of treating dry eye syndrome (DES), particularly because it can be challenging to cure completely. Patients with diabetes are more susceptible to developing DES compared to those without diabetes.¹¹

In this study, the prevalence of dry eye among patients with type 2 diabetes mellitus (DM) was found to be 17.1%. The majority of these cases (9%) were classified as mild. Hasan et al.¹² supported these findings, indicating a prevalence of 20% for mild cases. Moss et al.¹³, Seifart and Stempel¹⁴, and Nepp et al.¹⁵ found that prevalences of dry eye among

patients with type 2 diabetes were 19.8%, 70%, and 43%, respectively. The prevalence observed in the present study falls within the mid-range of previous findings, which have shown a wide variation ranging from 18% to 70%.

This study highlighted a rise in dry eye incidence with age, with the majority (52%) of diagnosed patients falling within the 40–70 years age bracket. Kaiserman et al.¹⁶ similarly observed an age-related escalation in dry eye prevalence. Schultz et al.¹⁷ suggested that age-related factors, such as heightened tear evaporation and changes in tear film osmolarity, play significant roles in the development of dry eye syndrome.

Recent research by Ranjan et al.¹⁸ has established a connection between age and the prevalence of dry eye disease (DED). They highlighted that hormonal changes during premenopausal and postmenopausal phases may contribute to increased rates of DED during these periods. Based on our study, hormonal influences may affect the occurrence of DED in women before and after menopause. We also observed a significant increase in the severity of diabetic retinopathy (DR) with advancing age, and identified a correlation between sex and DR grades in our research. Zhang et al.¹⁹ and Ozawa et al.²⁰ investigated the relationship between the prevalence of DR in males and females. Diabetes duration emerged as a significant risk factor for developing DED in our study. We observed a higher prevalence of DED among individuals with longer durations of diabetes. Additionally, females (54%) were more affected than males (46%) in our findings. Sex and age have been identified as influential factors in dry eye disease (DED). Zhang et al.¹⁹ and Burda et al.¹¹ observed a notable association between diabetes duration and the prevalence of DED.

Our study revealed a connection between dry eye disease (DED) and diabetic retinopathy (DR) in individuals with type 2 diabetes (T2D). This means that there was evidence suggesting that having dry eye disease (DED) was associated with an increased likelihood of also having diabetic retinopathy (DR) in patients diagnosed with type 2 diabetes (T2D). We observed higher severity of DR in males, with females exhibiting a lower incidence of DED. Research by Ozawa et al. in 2012 and 2015 strongly indicated that neuro-retinal abnormalities play a significant role in the severity of diabetic retinopathy (DR) among men diagnosed with type 2 diabetes (T2D).²⁰ Najafi et al.²¹ highlighted the significance of diabetic individuals monitoring and managing their blood glucose levels to mitigate potential long-term complications such as dry eye syndrome and retinopathy.

Increased HbA1c levels were observed to compromise the tear film lipid layer, leading to higher evaporation rates and reduced tear production.

V. CONCLUSION

Dry eye disease (DED) prevalence was notably elevated among diabetic patients compared to healthy subjects. Our community-based study indicated an overall DED prevalence that was lower than rates reported in previous hospital-based studies. Diabetic patients who have difficulty controlling their blood glucose levels are more susceptible to developing dry eye disease (DED). Therefore, it is advisable to include DED assessments as a standard part of routine diabetes screenings. This proactive approach can help identify and manage DED early, potentially preventing complications and improving overall eye health outcomes for diabetic individuals. Specifically, our study found a DED prevalence of 17.1%, which is lower than the rates reported in hospital-based studies. Patients with diabetes and poor metabolic control were more prone to developing DED. These results underscore the importance of including dry eye examinations in the regular screening protocol for diabetic patients.

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