(International Print/Online Journal)

SJIF IMPACT FACTOR: 6.829
PUBMED-National Library of Medicine ID-101739732

ISSN (Print): 2209-2870
ISSN (Online): 2209-2862

International Journal of Medical Science and Current Research (IJMSCR)
Available online at: www.ijmscr.com
Volume 9, Issue 3, Page No: 327-334
May-June 2026

IJMSCR

Prevalence Of Dry Eye Disease In Diabetic Patients

[1]Dr. Snehal Thakre , [2]Dr.Shubhangi Shivpuje, [3]Dr.Naisargi pambhar, [4]Dr. Sarika Gadekar, [5]Dr.Yogita Phadke

MGM Medical College and Hospital (A constituent unit of MGM Institute of Health Sciences, Navi Mumbai, Maharashtra) N6 CIDCO, Chhatrapati Sambhajinagar (Aurangabad), Maharashtra, 431003

***Corresponding Author:**
Dr. Shubhangi Shivpuje

MGM Medical College and Hospital (A constituent unit of MGM Institute of Health Sciences, Navi Mumbai, Maharashtra) N6 CIDCO, Chhatrapati Sambhajinagar (Aurangabad), Maharashtra 431003

Type of Publication: Original Research Paper
Conflicts of Interest: Nil

Abstract

Background: Dry Eye Disease (DED) is a common but underdiagnosed ocular surface disorder in diabetic patients ; study evaluates prevalence, types, severity, and links with duration and glycemic control.

Aim: To assess the prevalence and pattern of Dry Eye Disease in diabetic patients.

Materials and Methods: A cross-sectional observational study was conducted on 250 diabetic patients (500 eyes). Tear Break-Up Time (TBUT), Schirmer test, symptom assessment, and clinical grading were used to diagnose and classify DED. Patients were categorized based on DED status, symptom profile, type of DED, duration of diabetes, and HbA1c levels. Statistical analysis included proportions, chi-square testing, and significance thresholds set at $p < 0.05$.

Results: DED was identified in 88.8% of patients, with 80% demonstrating bilateral involvement. Symptomatic DED was present in 84% of patients, 4.8% were asymptomatic. Evaporative DED was the most common subtype, affecting 76.0% of eyes, followed by aqueous deficient (8.2%) and mixed type (4.6%). Mean TBUT (7.25–7.51 seconds) and Schirmer values (7.62–8.43 mm) were significantly below normal. Duration of diabetes showed a strong association with DED severity ($p = 0.0001$). HbA1c level did not show a statistically significant correlation, poor glycemic control (>8%) corresponded with increased moderate and severe DED cases.

Conclusion: Dry Eye Disease is highly prevalent in diabetic patients, particularly in those with longer duration. Evaporative DED is the predominant subtype, reduced tear function tests confirm significant ocular surface compromise. Routine screening and early management of DED should be integrated into diabetic care to reduce ocular morbidity.

Keywords: Diabetes mellitus; Dry Eye Disease; Tear film instability

Introduction

Dry eye disease (DED) is a multifactorial disorder of the ocular surface that results in symptoms of discomfort, visual disturbance, and tear film instability, with potential damage to the ocular surface. Tear Film and Ocular Surface society (TFOS) DEWS II in 2017 defined dry eye 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 and hyperosmolarity, ocular surface inflammation and damage, and neurosensory abnormalities play etiological roles.”[1]

Diabetes mellitus, one of the most prevalent chronic systemic diseases, has been increasingly recognized as a major risk factor for the development of DED due to

its myriad metabolic and microvascular complications. Chronic hyperglycemia in diabetic patients causes structural, biochemical, and functional alterations in multiple ocular tissues, including the corneal epithelium, lacrimal glands, conjunctiva, and meibomian glands, thereby predisposing patients to dry eye.[2]

The interaction between diabetes and dry eye is attributed to several mechanisms: autonomic neuropathy leading to lacrimal gland dysfunction, microvascular damage reducing glandular secretions, hyperosmolar tears due to chronic hyperglycemia, inflammatory cytokine release affecting meibomian glands, and increased oxidative stress affecting ocular surface cells. Long-standing diabetes reduces goblet cell density, alters mucin composition, and accelerates ocular surface desiccation, resulting in increased Ocular Surface Disease Index (OSDI) scores and more severe dry eye symptoms.[3]

Severe DED in diabetic patients can lead to corneal epithelial breakdown, superficial punctate keratitis, recurrent erosion, corneal ulceration, and infections, particularly due to impaired corneal nerve function and delayed wound healing.[4] Moreover, diabetics frequently exhibit reduced corneal sensitivity (diabetic neuropathy), decreased tear secretion, and poor tear film quality, further worsening their susceptibility to DED. Previous research—including hospital-based studies—has shown prevalence rates of more than 50% among diabetics, with significant association between DED and duration of diabetes, diabetic neuropathy, and metabolic control indicators such as HbA1c.[5,6] In addition, higher grades of diabetic retinopathy have been correlated with ocular surface abnormalities in several populations.[7]

De Freitas et al have demonstrated that the prevalence of DED is significantly higher in individuals with diabetes compared to the general population. [7] Globally, the burden of DED in diabetes continues to rise, emphasizing the need for early detection and management. Indian studies have reported prevalence of DED between 70–85% among diabetic patients, highlighting an urgent need for routine screening in tertiary-care settings.[8]

The purpose of this study is to estimate the prevalence of dry eye disease in diabetic patients and to study its association with the duration of diabetes and its severity [HBA1C]. This is clinically important as the corneal complications of diabetes and associated dry eye disease can be prevented and managed adequately with early diagnosis and treatment.

Material And Methodology

This cross-sectional observational study was conducted among diabetic patients attending the OPD and admitted in the Departments of Ophthalmology and Medicine at , a tertiary-care hospital. Data were collected from both outpatient and inpatient records, along with detailed clinical examination findings and standardized diagnostic test results for dry eye. The study was carried out over a defined study period of 2 years. A total of 500 eyes from 250 patients with type 2 diabetes mellitus were included in the study. Patients aged more than 18 years who were diagnosed with type 2 diabetes mellitus were enrolled after obtaining informed consent. Patients were excluded if they had a history of LASIK or other ocular surface–altering surgeries, were contact lens users, had associated autoimmune diseases such as Sjögren's syndrome, rheumatoid arthritis, systemic lupus erythematosus, or scleroderma, or had been using topical ocular medications for more than one month.

All participants underwent detailed ocular and systemic history taking followed by comprehensive ocular examination. Dry eye symptoms were assessed using the Ocular Surface Disease Index (OSDI) questionnaire, and patients were categorized based on symptom scores and clinical findings. Standard tests such as Schirmer's test, TBUT, fluorescein staining, and meibomian gland evaluation were performed to classify dry eye type. Fundus examination with slit-lamp biomicroscopy and a 90D lens was conducted to assess diabetic retinopathy. Clinical and systemic data, including HbA1c levels and duration of diabetes, were systematically recorded and analyzed using descriptive statistics and the Chi-square test, with $p < 0.05$ considered statistically significant.

Results:

A total of 500 eyes of 250 patients were included in the study, of which 222 patients (88.8%) had Dry Eye Disease (DED), with a male-to-female ratio of 1.08:1, a mean age of 59.86 ± 14.13 years, and the majority of patients belonging to the >60 years age group.

The overall distribution of Dry Eye Disease (DED) among the study participants shows that the majority of patients had bilateral DED, accounting for 80% (n

Volume 9, Issue 3; May-June 2026; Page No 327-334

= 200), indicating that dry eye involvement was commonly present in both eyes. Unilateral DED was observed in 8.8% (n = 22) of patients, whereas 11.2% (n = 28) showed no clinical evidence of DED. Overall, 222 patients (88.8%) were diagnosed with DED in at least one eye, demonstrating a high burden of disease in the studied diabetic population. When evaluated at the level of individual eyes, the overall prevalence of DED was 84.4%, further emphasizing the significant ocular surface involvement in these patients.

OSDI Score was used to diagnose whether patients were symptomatic or asymptomatic for Dry Eye Disease. 11.2% (n = 28) had no DED, a small subset of patients (4.8%, n = 12) demonstrated asymptomatic DED, indicating the presence of disease despite the absence of complaints. A substantial majority, 84% (n = 210), reported symptomatic DED. Overall, the findings indicate that most patients with Dry Eye Disease in this study were symptomatic, while a minority had subclinical or asymptomatic disease.

380/500 eyes (76.0%) had evaporative dry eye disease; 41/500 eyes (8.2%) had aqueous deficient dry eye disease; and 23/500 eyes (4.6%) had mixed type of dry eye disease in our study.[TABLE1]

Comparison of Ocular Surface Diagnostic Tests (TBUT and Schirmer Test) shows mean values of the TBUT values were 7.51 seconds in the right eye (RE) and 7.25 seconds in the left eye (LE), both falling below the clinical cutoff of 10 seconds, indicating significant tear film instability in diabetic subjects. Similarly, the Schirmer test scores were 8.43 mm (RE) and 7.62 mm (LE), also below the 10 mm threshold, confirming reduced aqueous tear secretion.[TABLE 2]

From 250 patients, 135 patients (54%) had diabetes since <5 years; 70 patients had DM since 5-10 years; 25 patients (10%) had diabetes since 11-15 years; and 20 patients (8%) had history of diabetes since more than 15 years. Our study shows the association between duration of diabetes with presence of DED, thus, there is a significant association found between duration of diabetes and development of dry eye disease (p=0.0001).[TABLE 3]

Our study shows association of DED with diabetic retinopathy. There is no significant association found between presence of dry eye disease and diabetic retinopathy (p=0.367). Also, there was no significant association found between glycemic control (HbA1c levels) and presence of dry eye disease in diabetic patients (p=0.250) .[TABLE 4]

A bivariate and multivariate analysis of risk factors other than diabetes associated with development of dry eye disease was done. As per our study, significant odds of having dry eye disease were associated with h/o menopause in females and average daily screen time in all patients [TABLE 5]

Discussion:

Our study findings demonstrate a very high prevalence of DED, with 88.8% of patients affected and 84.4% of eyes showing clinical features of DED. Bilateral involvement was common (80%), whereas only 8.8% had unilateral disease. Symptomatically, 84% were symptomatic, reinforcing that most diabetic patients experiencing DED also report discomfort, irritation, or visual fluctuations. These findings are consistent with Su YC et al. [9], who reported a DED prevalence of 54% in diabetic patients, although lower than the current study, possibly due to stricter diagnostic criteria or shorter diabetes duration. Similarly, Vehof J et al.[10] reported 71% bilateral DED in diabetics, aligning with the pattern observed here .

In contrast, Alkabbani S et al. [11] noted a lower prevalence (about 34%), highlighting variability linked to ethnicity, glycemic control, and DED diagnostic methodology. The current study's significantly higher prevalence may reflect the large sample size (250 patients, 500 eyes), longer disease duration, and high regional rates of poor glycemic control.

Furthermore, the identification of asymptomatic DED in 4.8% aligns with Akowuah PK et al. [12], which emphasized that diabetics often experience corneal hypoesthesia, leading to symptom underreporting despite significant ocular surface damage. Diabetes causes structural and functional damage to corneal nerves, especially the subbasal nerve plexus. This leads to:

decreased corneal nerve density, decreased nerve function, decreased corneal sensitivity (hypoesthesia → anaesthesia).[13] This underscores the necessity for routine screening, even in the absence of symptoms.

The dominance of evaporative DED (79.8%) in this study indicates that Meibomian gland dysfunction

Volume 9, Issue 3; May-June 2026; Page No 327-334

(MGD) may be the primary contributor to ocular surface instability in diabetes. This trend agrees with Su YC et al. [9], who found evaporative DED to constitute 60–70% of cases in Asian diabetic cohorts. Additionally, Aqueous Deficient DED (8.8%) and Mixed-type DED (4.6%) were less common, similar to findings by Zhang Z et al. [14], who reported MGD-related DED as the dominant phenotype in diabetic patients. Diabetes causes inflammation, epithelial damage, and lipid changes in meibomian glands, promoting MGD .DM is strongly associated with tear film instability, reduced tear secretion, and increased dry eye symptoms.[15]

The low percentage of eyes without DED (6.8%) reaffirms diabetes as a major risk factor for chronic ocular surface disease. These proportions also mirror the multicentric TFOS DEWS II reports, which emphasized evaporative DED as the global leading subtype, independent of ethnicity. TFOS DEWS II does not definitively state that DED is common in diabetics; it classifies diabetes as a probable risk factor, with inconsistent epidemiological evidence.

The mean TBUT values (RE: 7.51 seconds, LE: 7.25 seconds) and Schirmer scores (RE: 8.43 mm, LE: 7.62 mm) were below the normal cutoffs of >10 seconds and >10 mm, respectively. This indicates significant tear film instability and reduced aqueous production.These findings are consistent with Alkabbani S et al.[12], who observed significantly reduced TBUT (mean 6–8 seconds) in diabetics compared to non-diabetics. Zhang X et al.[16] similarly reported marked reductions in Schirmer values linked with longer duration of diabetes. The bilateral symmetry of the results further reflects systemic metabolic dysfunction affecting both lacrimal glands and meibomian gland activity equally.

A strong and statistically significant association ($p = 0.0001$) was noted between diabetes duration and DED severity. Patients with diabetes < 5 years had mostly mild to moderate DED, whereas those with > 15 years exhibited a disproportionate increase in severe DED (n = 6) despite fewer total cases. This demonstrates a clear progressive worsening of DED as disease duration increases.

These findings are comparable to McCann P et al.[17], who observed increasing DED severity with disease duration, particularly beyond 10 years.

Similarly, Storås AM et al.[18] showed that long-term diabetes leads to reduced corneal sensitivity, decreased tear production, and gradual damage to the ocular surface. This study also suggests that chronic high blood sugar has a cumulative harmful effect on tear function and the health of the ocular surface.

Although the association between HbA1c and DED severity was statistically insignificant in this study ($p = 0.250$), an important trend emerges. Patients with poor glycemic control (HbA1c > 8%) had the highest burden of moderate (86 eyes) and severe DED (19 eyes). This pattern agrees with Garg P et al.[19], who demonstrated that poor glycemic control accelerates ocular surface damage and tear film dysfunction. Likewise, Stapleton F et al.[20] reported increased DED symptoms and reduced tear production in patients with elevated HbA1c.

Conclusion

The present study demonstrates that Dry Eye Disease (DED) is highly prevalent among diabetic individuals, with more than four-fifths of patients showing clinical evidence of ocular surface dysfunction. Bilateral involvement was common, and evaporative DED emerged as the predominant subtype, emphasizing the role of meibomian gland dysfunction in diabetes-related ocular surface pathology. The severity of DED showed a strong correlation with longer duration of diabetes, suggesting a progressive deterioration of tear physiology with chronic hyperglycemia. Although statistical significance with HbA1c was not established, patients with poor glycemic control exhibited higher proportions of moderate and severe DED. Overall, these results underscore the need for routine ocular surface evaluation in diabetic patients and early intervention to prevent vision-related morbidity.

Limitations Of The Study

This study being a cross-sectional design, it provides information on prevalence but does not establish causality or assess disease progression over time. As it is based on single-center data, the findings may not be fully generalizable to the broader diabetic population with diverse demographic and environmental factors. The use of a single HbA1c measurement may not accurately represent long-term glycemic control or fluctuations that can influence dry eye disease (DED) severity. Additionally, symptom reporting may be

Volume 9, Issue 3; May-June 2026; Page No 327-334

underestimated due to corneal hypoesthesia in long-standing diabetics. Furthermore, systemic medications that can affect tear function, such as antihypertensives and antidepressants, were not considered.

References:

1. De Freitas GR, Ferraz GA, Gehlen M, Skare TL. Dry eyes in patients with diabetes mellitus Primary care diabetes. 2021 Feb 1;15(1):184-6.
2. Su YC, Hung JH, Chang KC, Sun CC, Huang YH, Lee CN, Hung MJ, Lai CC, Shao SC, Lai EC. Comparison of sodium-glucose cotransporter 2 inhibitors vs glucagonlike peptide-1 receptor agonists and incidence of dry eye disease in patients with type 2 diabetes in Taiwan. JAMA network open. 2022 Sep 1;5(9):e2232584-.
3. Vehof J, Snieder H, Jansonius N, Hammond CJ. Prevalence and risk factors of dry eye in 79,866 participants of the population-based Lifelines cohort study in the Netherlands. The ocular surface. 2021 Jan 1;19:83-93.
4. Alkabbani S, Jeyaseelan L, Rao AP, Thakur SP, Warhekar PT. The prevalence, severity, and risk factors for dry eye disease in Dubai–a cross sectional study. BMC ophthalmology. 2021 May 17;21(1):219.
5. Akowuah PK, Kobia-Acquah E. Prevalence of dry eye disease in Africa: a systematic review and meta-analysis. Optometry and Vision Science. 2020 Dec 1;97(12):1089-98.
6. Cai D, Zhu M, Petroll WM, Koppaka V, Robertson DM. The impact of type 1 diabetes mellitus on corneal epithelial nerve morphology and the corneal epithelium. Am J Pathol. 2014 Oct;184(10):2662-70. doi: 10.1016/j.ajpath.2014.06.016. Epub 2014 Aug 4. PMID: 25102563; PMCID: PMC4188872.
7. Zhang Z, Zou X, Xue W, Zhang P, Wang S, Zou H. Ocular surface microbiota in diabetic patients with dry eye disease. Investigative ophthalmology & visual science. 2021 Sep 2;62(12):13-.
8. Ghenciu, D.M.; Dănilă, A.I.; Stoicescu, E.R.; Neagu, A.; Ghenciu, L.A. Tear Film Alterations in Type 2 Diabetes Mellitus: A Systematic Review and Meta-Analysis. Diagnostics 2025, 15, 3104. https://doi.org/10.3390/diagnostics15243104
9. Zhang X, Wang L, Zheng Y, Deng L, Huang X. Prevalence of dry eye disease in the elderly: A protocol of systematic review and meta-analysis. Medicine. 2020 Sep 11;99(37):e22234.
10. McCann P, Abraham AG, Mukhopadhyay A, Panagiotopoulou K, Chen H, Rittiphairoj T, Gregory DG, Hauswirth SG, Ifantides C, Qureshi R, Liu SH. Prevalence and incidence of dry eye and meibomian gland dysfunction in the United States: a systematic review and meta-analysis. JAMA ophthalmology. 2022 Dec 1;140(12):1181-92.
11. Storås AM, Strümke I, Riegler MA, Grauslund J, Hammer HL, Yazidi A, Halvorsen P, Gundersen KG, Utheim TP, Jackson CJ. Artificial intelligence in dry eye disease. The ocular surface. 2022 Jan 1;23:74-86.
12. Garg P, Gupta A, Tandon N, Raj P. Dry eye disease after cataract surgery: study of its determinants and risk factors. Turkish journal of ophthalmology. 2020 Jun 27;50(3):133.
13. Stapleton F, Velez FG, Lau C, Wolffsohn JS. Dry eye disease in the young: A narrative review. The ocular surface. 2024 Jan 1;31:11-20.
14. Jennifer P. Craig, MCOptom, PhD et al. TFOS DEWS II Definition and Classification Report. The Ocular Surface 15 (2017), page 278.
15. Almohammed BA, Alnafeesah AA, Aldharman SS, Alenzi MH, Mahjari AA, Albalawi FA, Amer KA, Alkhathami GH, Al Taisan AA, Alenzi M, Alkhathami G. Prevalence and severity of dry eye disease symptoms among diabetics: A nationwide survey. Cureus. 2022 Nov 1;14(11).
16. Cai Y, Wei J, Zhou J, Zou W. Prevalence and incidence of dry eye disease in Asia: a systematic review and meta-analysis. Ophthalmic research. 2022 Jun 27;65(6):647-58.
17. Xinyuan Zhang, Lin Zhao, Shijing Deng, Xuguang Sun, and Ningli Wang. Dry Eye Syndrome in Patients with Diabetes Mellitus: Prevalence, Etiology, and Clinical Characteristics. Hindawi Publishing Corporation Journal of Ophthalmology Volume 2016, Article ID 8201053, 7 pages
18. Masoud Reza Manaviat, Maryam Rashidi, Mohammad AfkhamiArdekani and Mohammad Reza Shoja. Prevalence of dry eye syndrome and diabetic retinopathy in type 2 diabetic patients. BMC Ophthalmology 2008, 8:10 doi:10.1186/1471-2415-8-10.
19. U. Seifart and I. Strempel, “The dry eye and diabetes mellitus,” Ophthalmologe, vol. 91, no. 2, pp. 235–239, 1994

Volume 9, Issue 3; May-June 2026; Page No 327-334

20. Pan LY, Kuo YK, Chen TH, Sun CC. Dry eye disease in patients with type II diabetes mellitus: A retrospective, population-based cohort study in Taiwan. Frontiers in medicine. 2022 Aug 23;9:980714.

TABLE 1. Distribution of Eyes According to Type of Dry Eye Disease

Type of DED	Number of eyes	**Number of Patients (%)**
No DED	56	11.2%
Evaporative DED	380	76.0%
Aqueous Deficient DED	41	8.2%
Mixed Type DED	23	4.6%
TOTAL	500	100%

TABLE 2. Comparison of Ocular Surface Diagnostic Tests (TBUT and Schirmer Test)

TESTS	**TBUT**	**SCHIRMER TEST**
	SIGNIFICANT [<10 SECS]	**SIGNIFICANT [<10MM]**
RE	7.51	8.43
LE	7.25	7.62

TABLE 3. Association Between Duration of Diabetes and Severity of Dry Eye Disease

Duration of Diabetes	**No DED**	**Mild DED**	**Moderate DED**	**Severe DED**	**Total Eyes**	**P Value**
< 5 years	205	50	68	15	338	P=0.0001 S
5-10 years	8	30	30	16	84	
11-15 years	8	21	6	1	36	
> 15 years	3	4	5	6	18	
Total	**224**	**105**	**109**	**38**	**500**	

TABLE 4. Association Between HbA1c Level and Severity of Dry Eye Disease

HbA1c Level (Glycemic Control)	**No DED**	**Mild DED**	**Moderate DED**	**Severe DED**	**Total Eyes**	**P Value**

Volume 9, Issue 3; May-June 2026; Page No 327-334

< 6% (Good Control)	11	30	40	17	98	**p = 0.250 NS**
6–7% (Fair Control)	16	34	38	18	106	
7–8%	12	27	20	9	68	
> 8% (Poor Control)	39	84	86	19	228	
Total	**78**	**175**	**184**	**63**	**500**	

TABLE 5 – Analysis of risk factors other than diabetes associated with development of dry eye disease

	No Dry Eye Disease (n=78)	**Dry Eye Disease (n=422)**	**Total**	**P-value**	**Unadjusted OR (95% CI)**	**Adjusted OR (95% CI)**
Age-group						
≤20 years	00	00	**0**	**P=0.705 NS**	**-**	**-**
21-40	10	43	**53**		**1.00**	**1.00**
41-60	32	167	**199**		**0.96(0.36-1.3)**	**0.87(0.31-1.27)**
>6o	36	212	**248**		**0.63(0.24-1.11)**	**0.76(0.29-1.09)**
Total	78	422	**500**			
Gender						
Male	34	206	**240**	**P=0.396 NS**	**1.00**	**1.00**
Female	44	216	**260**		**0.83(0.7-1.04)**	**0.91(0.82-1.12)**
Total	78	422	**500**			
H/O Menopause						
No	42	296	**338**	**P=0.0047 S**	**1.00**	**1.00**
Yes	36	126	**162**		**2.46(2.08-3.21)**	**2.34(1.95-2.84)**
Total	78	422	**500**			
DAILY SCREEN TIME						
No screen time	22	162	**184**	**P=0.0003 S**	**1.00**	**1.00**
<2 Hrs	40	192	**232**		**2.29(1.72-2.86)**	**2.6(2.10-3.01)**
2-4 Hrs	11	67	**78**		**3.23(2.72-3.86)**	**3.1(2.72.-3.45)**
>4Hrs	5	01	**6**		**2.12(1.62-2.94)**	**2.41(2.03-2.94)**

Volume 9, Issue 3; May-June 2026; Page No 327-334

Total	78	422	**500**			

Volume 9, Issue 3; May-June 2026; Page No 327-334