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Original Article

A Study of Severity of Dry Eye and Meibomian Gland Dysfunction in Diabetics vs Non-Diabetics

Dr. Kundhan Kumar. Pasam[1], Dr. Niveditha RK[2], Dr. JayaShree S Shah[3]

[1] *Junior Resident, Department of Ophthalmology, Sri Siddhartha Medical College and Research Centre.*
[2] *Associate Professor. Department of Ophthalmology, Sri Siddhartha Medical College and Research Centre.*
[3] *Professor and Head. Department of Ophthalmology, Sri Siddhartha Medical College and Research Centre.*

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Corresponding Author:

Dr. Kundhan Kumar. Pasam
Junior Resident, Department of Ophthalmology, Sri Siddhartha Medical College and Research Centre.

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ABSTRACT

Background: Diabetes mellitus is associated with multiple ocular surface disorders, including dry eye disease and Meibomian gland dysfunction, both of which significantly affect visual comfort and quality of life. Altered tear film dynamics, inflammation, and glandular dysfunction in diabetic patients may contribute to increased severity of these conditions.
Aim: To evaluate and compare the severity of dry eye disease and Meibomian gland dysfunction in diabetic and non-diabetic individuals.
Materials and Methods: This comparative cross-sectional study included 120 participants, comprising 60 diabetic patients and 60 age-matched non-diabetic controls. All participants underwent comprehensive ocular examination. Dry eye disease was assessed using Tear Film Break-Up Time, Schirmer's test, ocular surface staining with fluorescein dye, and tear meniscal height measurement. Meibomian gland dysfunction was evaluated based on lid margin findings and meibum expressibility using slit-lamp examination. Data were analyzed to compare prevalence and severity between the two groups.
Results: Dry eye disease was observed in 53% of diabetic patients compared to 15% of non-diabetic individuals. Among diabetic patients with dry eye disease, 40% showed associated Meibomian gland dysfunction. Diabetics demonstrated significantly reduced tear film stability and tear production, along with higher grades of Meibomian gland dysfunction.
Conclusion: Dry eye disease and Meibomian gland dysfunction are more prevalent and severe in diabetic patients than in non-diabetics. Routine screening and early management of ocular surface disorders should be incorporated into standard diabetic eye care to prevent disease progression and improve patient outcomes.

Keywords*: Diabetes mellitus, Dry eye disease, Meibomian gland dysfunction, Tear film instability, Ocular surface disorders*

INTRODUCTION

Diabetes mellitus (DM) is a systemic condition that can lead to various ocular complications such as acute orbital infection, hordeolum, variations in the refractive error, chronic inflammation of the lid, neovascular glaucoma, ptosis, diabetic retinopathy, oculomotor nerve palsies, cataract, dry eye disease (DED) and Meibomian gland dysfunction (MGD). Both these DED and MGD conditions can result in patient discomfort, visual disturbances. (1)

The pathophysiology of dry eye in diabetics involves altered tear film dynamics and inflammation, while MGD, characterized by abnormal meibum secretion, may exacerbate the dry eye condition. Previous studies have suggested that the prevalence and severity of these ocular conditions may be higher in diabetics. Understanding the relationship between diabetes and ocular surface health can provide insights into potential therapeutic interventions for diabetic patients with dry eye and MGD.

It is anticipated that diabetic patients will exhibit more severe dry eye symptoms and a higher prevalence of Meibomian gland dysfunction compared to the non-diabetic group. Diabetic patients may show poorer tear film stability, reduced tear

production and more significant Meibomian gland atrophy. This could be attributed to altered lipid composition in the tear film and inflammatory processes associated with diabetes.

The study may highlight the importance of routine screening for dry eye and MGD in diabetic patients, emphasizing the need for early intervention to manage these ocular conditions effectively and improve patient outcomes.

AIM AND OBJECTIVES

Aim

To evaluate and compare the severity of dry eye disease and Meibomian gland dysfunction between diabetic and non-diabetic individuals.

Objectives

1. To assess the severity of dry eye disease in diabetics and non-diabetics using standardized diagnostic tools.
2. To evaluate the severity of Meibomian gland dysfunction in both groups.
3. To compare the prevalence of dry eye and MGD between diabetics and non-diabetics.

MATERIALS AND METHODS

This comparative cross-sectional study included 120 participants, consisting of 60 diabetic patients and 60 age-matched non-diabetic controls.
The study is conducted at Dept of Ophthalmology, Sri Siddhartha Medical College, Tumkur, after obtaining ethical approval.

After obtaining informed consent, participants underwent a complete ocular examination. Dry eye disease (DED) and Meibomian gland dysfunction (MGD) are assessed using the following tests:

- Tear Film Break –up time (TBUT): To evaluate tear film stability.
- Schirmer's test: To assess tear production.
- Ocular surface staining: Using fluorescein dye to detect ocular surface damage.
- Tear Film Meniscal Height.
- Meibomian Gland Dysfunction (MGD) Grading: Meibomian gland function will be assessed by evaluating the expressibility of meibum and gland structure using slit lamp.

Inclusion criteria:

- Diabetic group: Individual aged more than 18yrs with a diagnosis of Type 1 or Type 2 diabetes.
- Non- diabetic group: Healthy individuals aged more than 18yrs without any history of diabetes, or contact lens use for at least 2 weeks.

Exclusion criteria:

- Pregnant or lactating women.
- Contact lens wearers.
- Patients on topical treatment that found to cause or worsen dry eye such as anti-glaucoma drugs, anti-histamines, mast cell stabilizer eye drops, antiviral drugs, beta blocker eye drops, NSAID eye drops etc..
- Cases who are on systemic or local drugs such as oral contraceptives, antidepressants, antihistamines, diuretics, which are associated with causation of dry eye.
- Cases with systemic diseases such as rheumatoid arthritis, Sjogren's syndrome, Parkinson's disease, and systemic lupus erythematousus and other ocular surface disorders associated with dry eye.
- Smokers.
- Patients with a history of cranial nerve injury or active ocular inflammation or infection.

SOURCE OF DATA: All patients both genders between 40 to 80 years of age, diagnosed to have diabetes attending outpatient department of OPHTHALMOLOGY,Sri Siddhartha Medical College and Hospital, Tumkur, Karnataka.
STUDY CENTER: Department of OPHTHALMOLOGY
Sri Siddhartha Medical College & Hospital, Tumkur.
STUDY DESIGN: Descriptive Study
DURATION OF STUDY: 18 months
SAMPLING METHOD: Purposive sampling

SAMPLE SIZE:

$$n = \frac{[Z(1-\alpha/2) + Z(1-\beta)]^2 \times [p_1 q_1 + p_2 q_2]}{(p_1 - p_2)^2}$$

Where Z(1-α/2) =1.96 (95% CI)
Z(1-β) =0.84 (90 % Power)

p_1 = 24% (proportion of MGD in diabetic patients)

p_2 =6% (proportion of MGD in non diabetic patients)

$(p_1 - p_2)$ = 18% (difference of proportion)

Minimum required sample is n=58 in each group i.e.
total minimum required sample size is 116

RESULTS

The study included patients across a wide age range, with a predominance of middle-aged and elderly individuals. A higher proportion of patients exhibited moderate dry eye disease, followed by severe and mild forms.

Group	Abnormal TBUT	Percentage
Diabetics (n=60)	38	**63%**
Non-diabetics (n=60)	12	**20%**

Group	Abnormal Schirmer	Percentage
Diabetics	26	**43%**
Non-diabetics	7	**12%**

Group	Low TMH	Percentage
Diabetics	22	**36%**
Non-diabetics	6	**10%**

Lid Margin Abnormalities Noted on Slit-Lamp
(engorged vessels, irregularity, displaced mucocutaneous junction, blocked orifices)

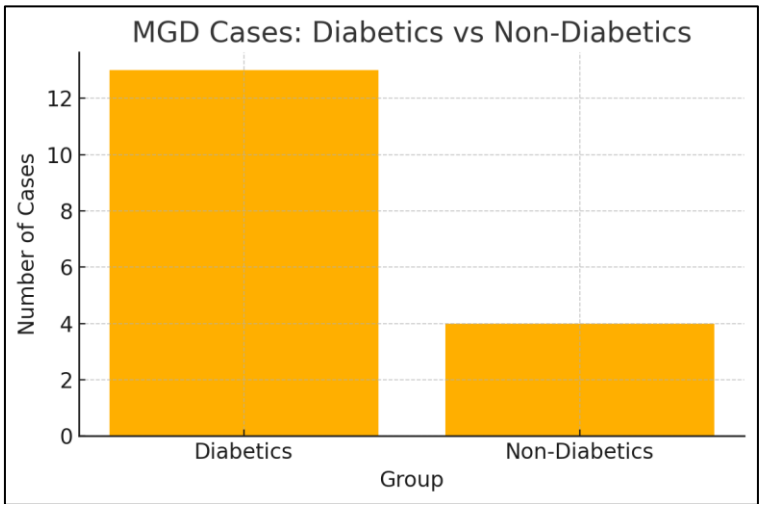
Finding	Diabetics (n=60)	%	Non-diabetics (n=60)	%
Lid margin irregularity	28	**47%**	10	**17%**
Vascular engorgement	22	**37%**	8	**13%**
Anterior/posterior MCJ shift	18	**30%**	5	**8%**
Blocked gland orifices	20	**33%**	6	**10%**

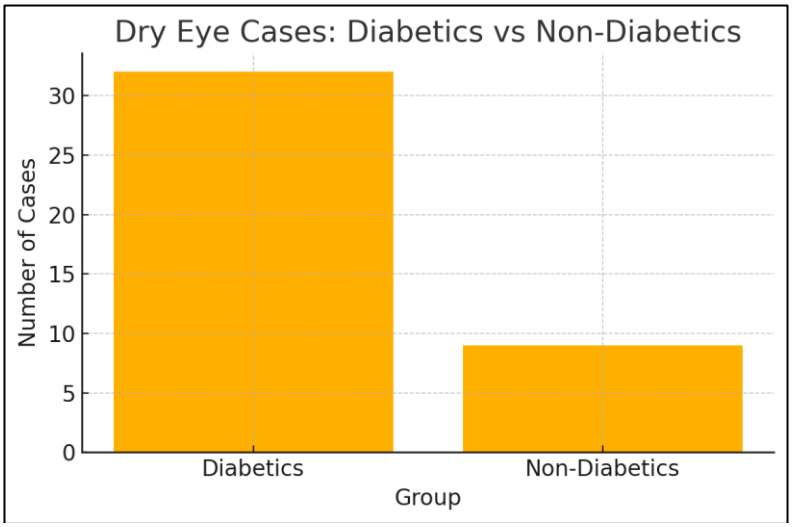
MGD Severity

Grade	Diabetics	Non-diabetics
Grade 1	9	2
Grade 2	3	1
Grade 3	1	1

Out of 60 diabetic patients, dry eye disorder was found in 32(53%) cases, among which 13 patients had MGD. Thirteen of 32 that is 40% of dry eye is credited to MGD.

Of 60 non-diabetics, 9 had dry eye disorder, among which 4 cases had MGD.





DISCUSSION

Dry Eye Disease is a prevalent ocular condition with multifactorial etiology, and Meibomian Gland Dysfunction plays a central role in disease pathogenesis. In the present study, a significant association was found between the severity of DED and the degree of MGD.

Similar findings were reported by **Nichols et al.**, who identified MGD as the leading cause of evaporative dry eye and emphasized its contribution to tear film instability[1]. **Lemp et al.** also highlighted that over 60% of dry eye patients exhibit features of MGD, consistent with our observations[2].

The predominance of moderate to severe dry eye in our study is comparable to results reported by **Arita et al.**, who demonstrated worsening tear film parameters with increasing meibomian gland dropout[3]. Reduced TBUT and altered lipid secretion observed in our study further support the role of MGD in exacerbating dry eye severity.

A study conducted by **T R Manjula et al2019** concluded that out of 100 diabetic patients, dry eye disorder was found in 56 (56%) cases, among which 24 patients had MGD. Twenty-four of 56 that is 42% of dry eye is credited to MGD and out of 100 non-diabetics, 15% had dry eye disorder, among which 6 cases had MGD. Diabetic patients are more susceptible for dry eye disorders when compared to normal subjects. In diabetics, the frequency of MGD is considerably more when compared to nondiabetic group. As the duration of DM increases prevalence and severity of MGD also increases proportionately.

A study conducted by **S.A. Arsha Ressal et al 2024** concluded
thatMGD was present in 62% of diabetic patientscompared to 40% of non-diabetic patients (p = 0.002). Amongdiabetics with MGD, 29% had mild, 45% moderate and 26% severe MGD.A positivecorrelation r = 0.58, p = 0.001) between diabe tes duration and MGD severity was noted. Diabetic patients had higher OSDI scores (34.7 vs.
28.3, p = 0.004). Warm compresses and lid hygiene showed significant
improvement in MGD severity (45% and 40% improvement, respectively).
Diabetic patients exhibit a higher prevalence and severity of MGD
compared to non-diabetic individuals, with prolonged diabetes duration exacerbating the condition.

A study conducted by **Abu E K et al2022** concluded that Prevalence of DED and MGD were 72.3% and 55.3% respectively. Symptomatic dry eye (OSDI scores) was significantly associated with duration of diabetes and the presence of conjunctival disorders. MGD was a risk factor for DED; ocular surface damage, the presence of eye lid lesions, abnormal Schirmer test and reduced TBUT were significantly associated with MGD, the strongest predictor being ocular surface damage. OSDI scores had no association with the presence of corneal lesions possibly due to reduced corneal sensitivity. DED and MGD were prevalent among the diabetic patients and therefore there is the need for dry eye assessment as a routine clinical management protocol for patients with type 2 diabetes.

A study by **Sultan S et al 2024** concluded that among 46 diabetic subjects, most of the subjects had mild gland opening for both the right and the left eye (50% and 54.3%). MGD score 1 was found in 12 (26.7%) and 11 (24.4%) subjects for the right and the left eye, respectively. Score 2 was observed mostly in the right eye 32 (71.1%) while score 3 was more frequent in the left eye 27 (60%). Most of the participants had moderate to severe loss of the meibomian gland in both eyes.

CONCLUSION

- Diabetic patients demonstrated a significantly higher prevalence of dry eye disease compared to age-matched non-diabetic individuals. Diabetes leads to both qualitative and quantitative alterations of the tear film, including reduced TBUT, decreased Schirmer's values, and increased ocular surface staining, reflecting instability of the tear film and chronic ocular surface compromise.
- Meibomian gland dysfunction was also more common in diabetics, and it contributed to a substantial proportion of dry eye cases, indicating that evaporative dry eye is an important component of diabetic ocular surface disease. Lid margin abnormalities and structural gland changes were also more pronounced in diabetics, highlighting the multifactorial nature of DED in this population.
- The severity and frequency of MGD were consistently higher in diabetics than in non-diabetics, supporting findings from previous studies that chronic hyperglycemia, autonomic neuropathy, loss of goblet cells, and meibomian gland epithelial dysfunction collectively contribute to tear film instability.
- These findings emphasize the need for routine screening of dry eye and MGD in diabetic patients, even in the absence of symptoms. Early detection and management—including control of modifiable risk factors—are crucial in preventing progression, improving patient comfort, and preserving ocular surface health.
- Integrating comprehensive dry eye evaluation into diabetic eye examinations should be considered essential clinical practice.

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