

Prevalence of Dry Eye Disease in Type 2 Diabetic Patients and its Association with Diabetic Retinopathy

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ABSTRACT

Objective: To determine the prevalence of dry eye disease in type 2 diabetic patients and its correlation with retinopathy

Materials and Methods: A cross-sectional study was conducted in the Department of Ophthalmology, Chandka Medical College & Shaheed Mohtarma Benazir Bhutto Medical University Larkana, from 1st April 2021 to 30th September 2021. Consecutive 100 patients with type 2 diabetes mellitus (DM) who attended outpatient department were included as per inclusion-exclusion criteria.

Results: The patients were mostly female (58%) with a female-to-male ratio of 1.38:1. Most patients (43%) were under 50, followed by 51–60. (34 %). The overall mean age was 54.26 10.06. More than half (63%) of patients had diabetes for up to 5 years. The patients had a 42 percent frequency of DES. Mild, moderate, and severe dry eye were diagnosed in 21%, 16%, and 5% of individuals. Longevity and poor diabetes control exacerbated the disease.

Conclusions: Type 2 DM patients' age, but not their gender, was found to be a significant predictor of DES. Dry eye was found to be more common among diabetics with poor control of their condition. In patients with type 2 diabetes, the age, but not the gender, was substantially linked to DES.

Keywords: Type 2 diabetes, Dry eye disease, Diabetic retinopathy, Meibomian gland dysfunction.

INTRODUCTION

By 2025, diabetes will affect 380 million people worldwide, a significant public health issue for both developing and developed countries alike¹. The prevalence of type 2 diabetes (T2D) has been linked to an increased risk of dry eye disease (DED), and this risk may grow as the prevalence of T2D rises^{2–6}. Up to 54.3% of diabetic people have DED, according to research². Decreased tear production and/or increased tear evaporation are both symptoms of dry eye disease (DED), which is a multifactorial condition.^{7,8} If you have DED, you may have signs and symptoms such as stinging, sandy sensations, a burning sensation in your eyelids, dryness, itching, and redness, all of which can lead to corneal irritation. There have also been reports of corneal problems in diabetic patients in recent years, such as superficial punctate keratopathy, trophic ulceration, and a persistent epithelial defect, among others². Diabetics aged 20 to 74 years are more likely to develop DED, which can lead to eye pain, visual problems, and eventually blindness⁹. A study found that roughly 20% of adults with T2D had dry eyes between the ages of 43 and 86 years. Hospital-based research has revealed even more significant connections between dry eyes and diabetes^{10,11}. By making people aware of the dangers of westernized food and drugs, as well as the use of electronic devices such as computers, we want to reduce the number of people who develop diabetes and die from DED. As the most common cause of vision

impairment and acquired blindness, Diabetic Retinopathy (DR) includes microvascular problems as well as other ocular issues.^{12,13} Type 2 diabetics are more likely to experience DR progression as their diabetes progresses, and there is a strong correlation between DR and DED in these patients.^{2–4} According to a hospital-based study, DR patients are more likely than non-DR patients to suffer from dry eye syndrome (DES). Furthermore, HbA1c^{2,3} was found to be related to both diabetic eye syndrome (DES) and diabetic retinopathy (retinopathy). The rising frequency of DED in T2D patients necessitates a focus on preventing and managing DED and its associated consequences. Patients who show signs and symptoms of DED should seek thorough eye treatment from ophthalmologists. The earlier DED can be detected and treated, the better the prognosis for diabetic people who are at risk of developing other dry eye issues down the road. As a result, researchers want to find out if DED is common among diabetics and if it has any bearing on how quickly DR progresses. Only a few research has looked at the prevalence of DED in combination with DR, although studies have revealed that DED and DR are more common in women than men among T2D patients.

MATERIAL AND METHODS

The study was carried out with 100 T2D patients who attended outpatient and in-patient department, Department of Ophthalmology in collaboration with the Department of

Ophthalmology, Chandka Medical College & Shaheed Mohtarma Benazir Bhutto Medical University Larkana, from 1st April 2021 to 30th September 2021. The age group selected for the study was 35-80 years. The ethical commission at the university gave its approval to the research. All patients involved in the study gave their informed consent after being fully informed about the findings. Fasting blood glucose levels (normal limit 110 mg/dl) were used to confirm the presence of T2D in all of the participants. New and re-examined T2D cases were included in the study based on the test results. Those with Type 1 diabetes, secondary diabetes, or who were taking antihistamines, tricyclic antidepressants, oral contraceptives, or diuretics were all ruled out of the experiment. Smokers, contact lens wearers, Lasik surgery patients, Sjogren's disease patients, and rheumatoid arthritis patients were also excluded from the study. Patients' medical records and direct interviews yielded clinical information such as gender, age, type of diabetes, and other medical conditions such as eye symptoms. To determine whether or not any T2D patients had dry eyes or symptoms of DR, all of them were examined visually.

Evaluation of Dry Eye: Tear break-up time [t-BUT], Schimer's test with a 5x35 mm strip of Whatman-41 filter paper, was used to confirm patients' eye discomfort, gritty feeling, itching, redness, and excessive tears are reported symptoms. The dry eye patients were divided into three groups based on the test results: minimally, moderately, and significantly DED. The prevalence of DED was also observed to differ by gender. Patients with dry eyes had their blepharitis and MGD severity assessed using a slit lamp. Patients were divided into two categories based on their ocular health: those with DED and those without DED.

Assessment of DR: All of the patients underwent a fundus examination to look for any alterations to their retinas. Using a Topcon TRC 50DX fundus camera for slit-lamp biomicroscopy and colorful fundus images (Topcon Medical Systems, Inc. NJ, USA) were used to diagnose and grade DR with a dilated fundus by the Early Treatment of Diabetic Retinopathy Study (ETDRS) criteria. Patients with diabetes and no symptoms of DR were separated based on the results of the fundus examination. There are three types of diabetic retinopathy patients: non-diabetic, diabetic, and non-proliferative.

Sample Preparation and Biochemical Assays: All participants gave a fasting blood sample of around 5ml in EDTA-coated wells to measure fasting blood sugar (FBS), post-prandial blood sugar (PPBS), and HbA1C. The glucose oxidase-peroxidase method was used to estimate FBS and PPBS, whereas the turbid metric approach was used to determine HbA1C.

Statistical Analysis: The statistical software SPSS was used to analyze the collected data (Version 22, SPSS, Inc., Chicago, Illinois, USA). Means and standard deviations were used to show the data. The significance of the differences between discrete variables was determined by the use of chi-square tests. P 0.05 was chosen as the level of significance.

RESULTS

A total number of 100 diabetic patients who attended the OPD, were included in this study. Mean age of the patients

was 54.26 ± 10.06 years. Most of the patients (43%) were between 40 and 50 years' age group. The study was female preponderant (58%). Forty-two (42%) dry eye patients were positive and the duration of diabetes was 8.07 ± 6.57 years (Table 1). There was a significant sex difference noticed in dry eye patients (P-value 0.001). Maximum number positivity was observed for tear film BUT test (32%) followed by Schirmer's (22%) and Rose Bengal staining (20%). Majority of the patients was suffering from diabetes for < 0.98).

Most of the patients had no diabetic retinopathic changes (68%) and only 32% of patients had diabetic retinopathic changes among them, moderate non-proliferative diabetic retinopathy was 11%. Maximum number of patients (40%) had visual acuity 6/24 to 6/60 (Table 4).

Table 1: Association of dry eyes with mean duration of diabetes (n=100)

Diagnostic test	Number of patients (n)	Duration in years (Mean ± SD)	P-value
Dry eye: Positive	42	8.07±6.57	0.001
Negative	58	4.19±3.70	

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	58
Present	42
Mild	21
Moderate	16
Severe	05

Table 3: Association of dry eyes with pertinent variables (n=100)

Variables	No. of patients (n=100)	Dry eye (n=42) (%)	Significance of Chi-square test	P-value
Age (years) ≤50	43	16 (37.2)	χ ² =2.59	0.273
50-60	34	13 (38.2)		
>60	23	13 (56.5)		
Sex Male	42	17 (40.47)	χ ² =0.069	0.793
Female	58	25 (43.10)		
Duration of diabetes (year) ≤10	86	32 (37.2)	χ ² =5.72	0.016
>10	14	10 (71.4)		
Blood sugar control (HbA1c) Good (4-6%)	26	10 (27.7)	χ ² =11.82	0.0008
Fair (7%)	22	06 (27.2)		
Action suggested (8%)	28	17 (60.7)		
Poor>8%	14	09 (64.2)		
Diabetic retinopathy No	65	27 (41.5)	χ ² =0.016	0.89
Yes	35	15 (42.8)		

Table 4: Distribution of the type 2 diabetes patients according to their visual acuity (Snellen's) (n=100)

Vision (Snellen's)	Right eye no. (%)	Left eye no. (%)
6/6-6/18	39 (39.0)	33 (33.0)
6/24-6/60	40 (40.0)	40 (40.0)

5/60–3/60	10 (10.0)	11 (11.0)
2/60–1/60	05 (5.0)	10 (10.0)
<1/60–perception of light (PL)	06 (6.0)	06 (6.0)
Total	100	100

DISCUSSION

When the tear film becomes dry, it can lead to tearing deficiency or excessive tear evaporation, which damages the ocular surface and causes symptoms of ocular discomfort. This condition is known as dry eye. About 28% of people with DED presented with symptoms of ocular illness, which was also common in the general population.¹³ Aside from the fact that dry eye isn't always treatable, managing the symptoms and preventing ocular surface damage are critical parts of its treatment. Diabetes patients are more likely than non-diabetics to get dry eye syndrome (DES).² In addition to affecting the tear gland, high blood glucose levels due to autonomic neuropathy change the typical chemical compositions of tears, resulting in an increased amount of glucose, causing dry eye symptoms. The key to avoiding and treating DED caused by T2D may therefore be to keep blood glucose levels under control. Out of 100 patients, we found that 53% had DED, and this was true for both sexes. When it comes to DED, women are more likely than men to suffer from it. Age and the prevalence of DED have recently been linked by Ranjan et al., 2016.¹⁴ Increases in premenopausal and postmenopausal rates may be linked to hormonal changes during these periods. According to our findings, hormones may have an impact on the occurrence of DED in women before and after menopause. We found that the severity of DR increased significantly with age, and that sex was linked to DR grades in our research. The relationship between the prevalence of DR in males and females was established by Zhang et al., 2016 and Ozawa et al., 2015.^{15,16} Diabetic duration is an important risk factor for developing DED. Our research found a much higher frequency of DED in those with diabetes over a longer period and found that females (57.4 percent) were more likely than males to have the condition (43.8 percent). The majority (43.8 %). Sexes, as well as age, were found to influence DED. Both Zhang and Burda et al.^{2,13} discovered a significant link between diabetes duration and DED prevalence, with the prevalence of dry eye increasing as the duration increased. The results showed that DED and DR were linked in T2D patients. DR was found in 57 out of 100 people, with men and women making up 21 and 36, respectively, of those who had it. Girls with DR had a considerably higher rate of DED than males. In contrast to this, there was a substantial difference in the prevalence of dry eye symptoms between men and women.¹⁷ Numerous investigations have also discovered a strong connection between DED and the DR3–5,¹⁵ phases. DR severity was observed to be higher among males and less incidence of DED in comparison to females, based on our research findings. The recent work of Ozawa et al. in 2012 and 2015 strongly suggested that abnormalities in neuro-retinal function are responsible for the severity of DR in T2D men.¹⁶ The frequency of DED was higher in T2D with DR in our study than in previous studies^{3–5,15}. which did not

find it. Preventing DED by proper glycemic control is important. As opposed to males with DED, girls with DED had worse glycemic control, as evidenced by our findings. There is a strong correlation between poor glycemic control and DED, and it appears that gender plays an important role. A correlation was found between high HbA1c levels and the presence of DED in studies conducted by Shaikh 2015.⁴ and Najafi et al., 2013.⁵ DED prevalence in diabetics is affected by the patient's glycemic condition, according to Shaikh.⁴ Dry eye and retinopathy have recently been linked to HbA1c⁵, according to a study conducted by Najafi et al., 2013 also strongly recommended that diabetic individuals are monitored and their blood glucose levels controlled if they want to avoid dry eye syndrome and retinopathy in the long term. Ocular surface defense is enhanced by the naturally occurring microbiome on the conjunctiva. Those who are diabetic are more prone to have blepharitic presentations because of the increased likelihood of opportunistic colonization of the eyelids in pathological conditions. This also results in a weaker tear film lipid layer, which evaporates more quickly and produces fewer tears. Diabetic eye disease has been linked to the condition by Ghasemi, 2008.¹⁸ MGD and DED have been linked by Shaikh (2015), who claims that peripheral neuropathy causes aqueous deficiency in dry eye and meibomitis, culminating in the evaporative dry eye in diabetics.⁴ Women were more likely than men to have MGD, which was linked to DED severity in T2D patients, according to the results of the current study. This finding supports the previous findings. The prevalence of DED-related Meibomian gland disease was found to be higher than in previous studies. MGD is more common in women, increases in frequency with age, and is impacted by hormonal status, according to Finis et al., 2012. Finis et al. discovered number.¹⁹

CONCLUSION

Increased age was a significant predictor of DES in patients with type 2 diabetes, but not sex. Dry eye was correlated directly with the length of diabetes. There was a correlation between diabetes and dry eye. Dry eye in diabetics can be prevented by detecting and controlling diabetes early. In future, the protocol of type 2 DM management should include dry eye assessment.

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