**ORIGINAL RESEARCH**

# A prospective clinical assessment of dry eye and diabetic retinopathy in diabetes mellitus: an observational study

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## ABSTRACT

**Aim:** The aim of the present study was to correlate the dry eye and diabetic retinopathy with duration of diabetes and blood urea and serum creatinine level.**Material & Methods:**A prospective clinical observational study was conducted for a period of 2 years.A written consent was obtained from the patients before subjecting them for detailed clinical examination. 200 cases of only type 2 diabetes mellitus patients who reported to eye OPD through referral from diabetology OPD and ward, medicine OPD and ward for routine diabetes eye screening were examined.**Results:** Out of 200 patients, 132 were female and 68 were male. Patients with diabetes duration under 1 year were 6%. 59% of the population was 1-5 years diabetes duration. 35% had dry eyes and 65% did not. 25% of patients had FBS <110mg/dl. 75 percent had FBS over 110mg/dl. 52 individuals had PPBS under 160 mg/dl. 148 had PPBS over 160 mg/dl. 172 individuals had blood urea below 40 mg/dl. 28 patients had blood urea over 40 mg. 180 individuals had serum creatinine <1 mg/dl. 20 individuals had serum creatinine >1 mg/dl. 16 of 60 Schirmer test positives had diabetes for 1-5 years. 20 had 6-10 years of diabetes. 16 had 11-20 years of diabetes. The aforementioned comparison P value was significant. 8 of 50 TBUT-positive patients had diabetes for 1-5 years, 32 for 6-10 years, and 10 for 11-20 years.**Conclusion:** A statistically significant positive link existed between dry eye, diabetes duration, and retinopathy severity. Therefore, all diabetics should be examined for retinal alterations and ocular surface problems immediately and treated. Treating ocular surface problems and diabetic retinopathy early prevents consequences. Maintaining glycemic control and timely follow-up should be stressed.

**Key words:**Dry eye, diabetes, diabetic retinopathy, schirmer test



## INTRODUCTION

The prevalence of dry eye illness in individuals with diabetes mellitus ranges from 15% to 33%. According to the latest 2016 statistics from the World Health Organisation (WHO), there were about 422 million persons worldwide living with diabetes mellitus in 2014, which is a significant increase from the 108 million reported in 1980[1].Out of the total number of persons with diabetes, only 5% are diagnosed with type 1 diabetes, while the remaining 95% are affected by type 2 diabetes. The latter is often linked to advanced age, obesity, lack of physical exercise, a family history of type 2 diabetes, or a personal history of gestational diabetes. Diabetes is responsible for 2.6% of blindness cases worldwide[2].

There have been recent reports of issues with the outer layer of the eye in diabetes individuals, specifically related to dry eye. These difficulties may lead to various consequences such as superficial punctate keratitis, trophic ulceration, and chronic epithelial defect[3].The impairment of corneal sensitivity is directly correlated with the degree of polyneuropathy and worsens as the duration of diabetes mellitus progresses[4, 5].The MNSI score indicated a severe case of polyneuropathy, which was accompanied by a reduction in corneal sensitivity and a decrease in the number of long nerve fibre bundles in the sub-basal nerve plexus, as shown in the *in vivo* confocal microscopic picture. The cornea is impacted at an early stage in the progression of polyneuropathy. Significantly diminished sub-basal nerve densities were seen in all individuals with polyneuropathy. Corneal sensitivity remains normal in cases of no or mild-to-moderate neuropathy. Neuropathy is only

considered severe when it affects individuals with diabetes who have had a limb amputated and a prosthetic eye. In these cases, there is a noticeable decrease in nerve density and corneal sensitivity, which may lead to further difficulties[6].

The Michigan Neuropathy Screening Instrument (MNSI) served as a diagnostic tool for assessing diabetic neuropathy. Feldman *et al.* found that the MNSI score had a sensitivity of 80% and a specificity of 95% in predicting diabetic neuropathy. There is an inverse association between the MNSI score and corneal sensitivity[7].In the first phases of diabetes, there is a rise in the thickness of the cornea. However, the thickness of the epithelium does not undergo any additional changes as the degree of neuropathy increases. Severe neuropathy may cause a decrease in neurotrophic stimuli, which might result in the development of a thin epithelium and increase the likelihood of recurrent corneal erosions[8].The decreased basal tear production supports the hypothesis that peripheral neuropathy affects the functioning of the lacrimal gland in individuals with long-standing diabetes and its consequences[9].Patients suffering from dry eyes have reduced sensitivity to mechanical, thermal, and chemical stimuli, which seems to be caused by damage to the nerves that provide sensation to the cornea[10].The objective was to establish a correlation between dry eye and diabetic retinopathy with the duration of diabetes, as well as the levels of blood urea and serum creatinine. Additionally, the aim was to assess the risk factors associated with dry eye and diabetic retinopathy in patients with diabetes mellitus, and to examine the prevalence of these conditions in such patients.

## MATERIAL & METHODS

Prospective clinical observational research was carried out for a duration of 2 years. Prior to conducting a comprehensive clinical examination, the patients were required to provide written permission. A total of 200 cases consisting exclusively of patients with type 2 diabetes mellitus, who were referred from the diabetology OPD and ward, medicine OPD and ward, for the purpose of regular diabetic eye screening, were evaluated at the eye OPD. These individuals were already receiving treatment with oral anti-diabetic medications, insulin, or a combination of both. The Institutional Ethical Committee granted ethical approval.

## INCLUSION CRITERIA

In this study, both male and female of age group between35 to 85 years were included.

All individuals were only undertype 2 diabetes mellitus.

## EXCLUSION CRITERIA

The patients with type 2 diabetes are linked to the use of contact lenses, long-term use of tricyclic antidepressants, beta blockers, and antihistamines. Our study excluded individuals with conditions such as rheumatoid arthritis, HIV infection, recent ocular surgeries, lupus, Parkinson's disease, ocular cicatricialpemphigoid, Steven-Johnson syndrome, keratoconjunctivitissicca, and meibomian gland dysfunction. We also excluded individuals who were taking certain medications, including antipsychiatric drugs, beta-blockers, diuretics, antihistamines, and tricyclic antidepressants. Additionally, we excluded individuals who had undergone LASIK surgery, were pregnant, had a vitamin A deficiency, had corneal edoema, wore contact lenses, had viral keratitis, had Hansen's disease, or had glaucoma. We omitted instances of type 1 diabetes mellitus from our investigation.

## METHODOLOGY

Data of all the patientsincluding age, sex, BMI, duration of diabetes, drug historylike whether on oral anti-diabetic drugs, insulin or both drugs,history of other associated conditions like hypertension,chronic kidney disease, hyperlipidaemia were obtained byreviewing the medical records and direct patient interview.The eye complaint like ocular discomfort, grittysensation, itching, redness, blurring of vision, which improves with blinking, burning sensation were recorded apart from defective vision. Visual acuity examination bySnellen chart distance and near vision examination,cycloplegic refraction, slit lamp examination, intraocularpressure assessment by applanation tonometer, fundusexamination by direct and indirect ophthalmoscope, angle ofanterior chamber assessment by Goldmann three mirrorgonioscopy, tear breakup time, Schirmer's test I, corneal sensitivity test, blood investigation like fasting andpostprandial blood sugar, Hb1AC, blood urea and serum creatinine and blood pressure recording were done in all theindividuals.

## STATISTICAL ANALYSIS

Statistical analysis was performed using Statistical Packagefor Social Sciences (SPSS version 12.0, Chicago IL). Chi square test and t-student test was used to compare discrete variables. Significance was considered to be $p<0.05$.Results were given with their 95% CIs. Data were presented as means ± SD.

## RESULTS

**Table 1: Demographic data**

| Gender | N% |
|---|---|
| Male | 68 (34) |
| Female | 132 (66) |
| **Duration range** | |
| Less than 1 year | 12 (6) |
| 1 to 5 years | 118 (59) |
| 6 to 10 years | 52 (26) |
| 11 to 20 years | 18 (9) |
| **Prevalence of dry eye symptoms** | |
| Absent | 130 (65) |
| Present | 70 (35) |

Among 200 patients studied, 132 patients were females and 68 patients were males. The patients diagnosed with diabetes less than 1 year duration were 6%. Majority of population were between 1 to 5 years duration i.e., 59%. 65% had no dry eye symptoms and 35% had dry eye symptoms.

**Table 2: Fasting and post prandial blood sugar range**

| Fasting blood sugar | N% |
|---|---|
| FBS < 110 | 50 (25) |
| FBS >110 | 150 (75) |
| **Post prandial blood sugar** | |
| Up to 160 | 52 (26) |
| Above 160 | 148 (74) |

25% of patients had FBS less than 110mg/dl. 75% had FBS more than 110mg/dl. 52 patients had PPBS less than 160 mg/dl. 148 patients had PPBS more than 160 mg/dl.

**Table 3: Blood Urea and Serum Creatinine Range**

| Blood Urea | N% |
|---|---|
| Upto 40mg/dl | 172 (86) |
| >40 mg/dl | 28 (14) |
| **Serum Creatinine** | |
| Upto 1mg/dl | 180 (90) |
| >1 mg/dl | 20 (10) |

172 patients had urea level less than 40 mg /dl. 28 patients had urea level more than 40 mg. 180 patients had Creatinine level less than 1 mg/dl. 20 patients had Creatinine more than 1 mg/dl.

**Table 4: Schirmer Test and Duration of Diabetes**

| Schirmer Test | Less than 1 year | 1 to 5 years | 6 to 10 years | 11 to 20 years |
|---|---|---|---|---|
| Positive | 0 | 16 | 20 | 16 |
| Negative | 10 | 104 | 30 | 4 |
| Total | 10 | 120 | 50 | 20 |

60 Schirmer test positive patients, 16 patients had 1 to 5 years of diabetes. 20 of them were 6 to 10 years of diabetes. 16 of them were 11 to 20 years of diabetes. The P value of above comparison was significant.

**Table 5:TBUT and Duration of Diabetes Mellitus**

| TBUT | Less than 1 year | 1 to 5 years | 6 to 10 years | 11 to 20 years |
|---|---|---|---|---|
| Positive | 0 | 8 | 32 | 10 |
| Negative | 10 | 112 | 18 | 10 |
| Total | 10 | 120 | 50 | 20 |

50 TBUT test positive patients, 8 of them were in 1 to 5 years duration of diabetes, 32 of the were in 6 to 10 years duration and 10 of them were in 11 to 20 years duration of diabetes.

**Fig 1: Slit Lamp examination**

## DISCUSSION

Dry eye is a condition characterised by a combination of factors that affect the tear film and the surface of the eye. This leads to symptoms such as vision impairment, discomfort, instability of the tear film, higher osmolarity of the tear film, and inflammation of the eye surface. This definition was established by the Dry Eye Workshop (DEWS) in 2007[11].The diminished corneal sensitivity promotes the development of dry eye syndrome (DES) by lowering the frequency of blinking, reducing the reflex-triggered production of tears, and increasing the loss of tears by evaporation[12].Several ideas elucidate the correlation between dry eye and diabetes. Hyperglycemia and microvascular injury to the neurons in the cornea can impede the feedback process that regulates tear secretion. Disruption of the innervation of the ocular surface impairs the appropriate secretion of tears by the lacrimal gland. Hyperglycemia induces inflammatory changes, leading to a decrease in tear production. Dry eye is both a source and a result of inflammation.

Out of the 200 patients examined, 132 were females and 68 were males. The prevalence of diabetes among patients with a duration of less than 1 year was 6%. The majority of the population, accounting for 59%, fell between the age range of 1 to 5 years. 65% of the participants did not have any symptoms of dry eye, whereas 35% reported having dry eye symptoms. According to a study conducted by Manaviat*et al.*, the prevalence of dry eye syndrome among individuals with diabetes was found to be 54.3%. A strong correlation was observed between dry eye syndrome and the length of time a person has had diabetes, and this correlation was more common in individuals with diabetic retinopathy[13].According to a study conducted by Pradeep *et al.*,the occurrence of dry eye among individuals with type 2 diabetes was found to be 32%. The study also revealed that the prevalence of dry eye was higher in older age groups and among those who had been living with diabetes mellitus for more than 10 years[14].The diminished corneal sensitivity observed in diabetic patients is considered to be a manifestation of the widespread polyneuropathy that occurs in these individuals[15].Corneal issues associated with diabetes, such as superficial punctate keratitis, chronic epithelial defects, and corneal endothelial damage, have been found to be connected to abnormalities in tear secretion, reduced corneal sensitivity, and inadequate adhesion between epithelial cells and their basement membrane[16].There is a correlation between reduced sensitivity in the cornea and the severity of diabetes. Patients with this symptom have been found to have more severe retinopathy and a longer duration of the condition[17].Diminished corneal sensitivity is a contributing factor to dry eye. Additionally, it increases the likelihood of corneal injury and the development of trophic corneal ulcers. Furthermore, it negatively impacts the healing process of corneal wounds[18, 19].

25% of patients had a fasting blood sugar (FBS) level below 110mg/dl. Seventy-five percent of the individuals had a fasting blood sugar level more than 110mg/dl. A total of 52 individuals exhibited postprandial blood sugar (PPBS) levels below 160 mg/dl. A total of 148 individuals exhibited postprandial blood sugar (PPBS) levels exceeding 160 mg/dl. A total of 172 individuals exhibited a urea level below 40 mg/dL. A total of 28 patients exhibited urea levels over 40 mg. A total of 180 patients exhibited a Creatinine level below 1 mg/dl. A total of 20 patients exhibited Creatinine levels over 1 mg/dl. Out of the 60 individuals that tested positive on the Schirmer test, 16 of them had been diagnosed with diabetes for a duration ranging from 1 to 5 years. Out of the total, 20 individuals had been diagnosed with diabetes for a duration of 6 to 10 years. Out of the total, 16 individuals had been diagnosed with diabetes for a duration ranging from 11 to 20 years. The P value of the aforementioned comparison was statistically significant. Out of the 50 patients who tested positive for TBUT, 8 had been diagnosed with diabetes for 1 to 5 years, 32 had been diagnosed for 6 to 10 years, and 10 had been diagnosed for 11 to 20 years. Diabetes-related corneal neuropathy and

microvascular problems can substantially impair tear film function and corneal sensitivity. The investigation of tear film alterations in diabetes individuals following cataract surgery has not been extensively studied.

## CONCLUSION

A positive link was found between dry eye and both the duration of diabetes and the severity of retinopathy. Therefore, it is imperative to promptly assess and examine all diabetes patients for retinal alterations and the existence of ocular surface problems, and subsequently administer appropriate treatment. Timely intervention could avert consequences linked to ocular surface diseases and diabetic retinopathy. It is important to emphasise the need for regular follow-up and the maintenance of appropriate glycemic control.

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