

# A Study of Frequency of Dry Eye in Type 2 Diabetes Mellitus Patients.

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## ABSTRACT

**Background:** The aim of the study is to find the frequency of dry eye in type 2 diabetes mellitus patients in a tertiary care centre in Western Uttar Pradesh region. **Methods:** A cross sectional observational study, conducted in the Department of Ophthalmology, Teerthankar Mahaveer Medical College and Hospital. A Total of 200 patients were enrolled, 100 in Type 2 diabetes mellitus group and 100 in non-diabetic group. Detailed ocular and diabetic history was recorded and clinical examination with slit-lamp for anterior segment was done. Schirmer's test (SchT), Tear breakup time (TBUT) were performed, and results noted. The stage of diabetic retinopathy was determined using direct and indirect ophthalmoscopy. **Results:** According to the present study, frequency of dry eye was more in diabetics (68%) as compared to non-diabetic patients (32%). Frequency of dry eye was maximum among the patients of above 60 years of age with 48.5% and 48.1% in diabetic and non-diabetic group respectively. Dry eye was more common in females in both the groups, 54.5% and 51.8% respectively. Dry eye was seen in 75% patients having diabetic retinopathy. Dryness (68%) and watering(21%) was the most common ocular symptom in diabetics and non-diabetics respectively. **Conclusion:** Dry eye have high frequency with diabetics and diagnosis for dry eye by TBUT and Schirmer's along with history of ocular symptoms can be utilized as screening tool. Dry eye appears more in higher age group and in females as compared to middle or younger age group. Frequency of dry eye is much higher in diabetics having diabetic retinopathy as compared to the other diabetic patients without diabetic retinopathy.

**Keywords:** Dry Eye, Schirmer's test, Type 2 Diabetes Mellitus.

## INTRODUCTION

Diabetes is one of the leading health related catastrophes the world has ever witnessed.<sup>[1]</sup> It affects millions of people all over the world. WHO has labeled India as "The diabetic capital of the world" as it has the highest number of diabetics in the world. It estimates that there will be 370 million people with diabetes on the planet by 2030, which is nearly twice the figure reported in 2000.<sup>[2]</sup>

Diabetes mellitus is related with a number of ocular complications which may even lead to blindness. Diabetic retinopathy, neovascular glaucoma, cataract, refractory deviations, ptosis, palsy of the oculomotor nerve, and hordeolosis are few ocular complications in diabetic patients.

Recently, problems involving the ocular surface, dry eyes in particular, have been reported in diabetic patients.<sup>[3]</sup> These patients suffer from a variety of corneal complications including superficial

punctuate keratopathy, trophic ulceration and persistent epithelial defect.<sup>[4]</sup>

DES (Dry eye syndrome) is one of the most frequently encountered ocular conditions especially in the elderly population. According to the international Dry Eye Disease Workshop (DEWS) in 2007,<sup>[5]</sup> DES is defined as multifactorial disease of the ocular surface resulting in symptoms of ocular discomfort, visual disturbance & tear film instability with potential damage to the ocular surface.

Dry eye syndrome has many causes. Common causes for dryness is aging process, lacrimal tissue destruction, absence or reduction of lacrimal gland tissue, conjunctival scarring with obstruction of lacrimal gland ductules, vitamin A deficiency.<sup>[6]</sup> Reduction in quality of life is inevitable when symptoms of dry eye occur.<sup>[7,8]</sup> These symptoms range from mild transient irritation to persistent dryness, burning, itching, redness, pain, ocular fatigue and visual disturbance. The mechanism responsible for dry eyes is unclear, but autonomic dysfunction may be responsible.<sup>[9]</sup> Aldosereductase, the first enzyme of the sorbitol pathway, may also be involved. The oral administration of aldose reductase inhibitors has been shown to improve the tear dynamics significantly.<sup>[10]</sup>

The 1995 NEI/Industry Dry EyeWorkshop identified two types of DES: aqueous tear-deficient (tear-

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deficient, lacrimal tear deficiency) and evaporative dry eye. HbA1c levels have also been seen to increase the chance of dry eye syndrome in type 2 diabetes mellitus patients. The higher the HbA1c values, the higher the rate of dry eye syndrome.<sup>[11]</sup>

DM associated dry eye may be tear-deficient or evaporative dry eye.<sup>[12]</sup> Dry eye can lead to vision deficit, scarring and perforation of the cornea and secondary bacterial infection. Therefore early diagnosis of dry eye syndrome in diabetic patients is important for beginning of treatment in early stages. This study is undertaken to study the prevalence of dry eye in type 2 diabetic patients and to highlight the significance of careful examination for dry eye in these subgroup of patients so as to prevent the adverse complications of dry eye and to symptomatically relieve the patient.

### Aim

To find the frequency of dry eye in type 2 diabetes mellitus patients in a tertiary care centre in Western Uttar Pradesh region.

### Objectives

To find the association between factors such as age, sex, ocular symptoms severity of diabetic retinopathy and frequency of dry eye in patients of type 2 diabetes mellitus.

## **MATERIALS AND METHODS**

This was a cross sectional observational study conducted in the Department of Ophthalmology, Teerthankar Mahaveer Medical College and Hospital Patients presented to the Out Patient Department between January 2017 to December 2017, enrolled in this study and divided into two groups: type 2 diabetes mellitus and non-diabetic patients. Clinical data of all patients including age, duration of diabetes, history of other diseases obtained by reviewing the medical records and direct patient interview.

In this study we took sample of 100 cases of type 2 diabetes mellitus and simultaneously, a sample of 100 cases of patients not suffering from diabetes mellitus

### Inclusion criteria for group 1

All patients diagnosed as type 2 diabetes Mellitus by a physician irrespective of duration of diabetes, age, glycemic control, symptomatic/ asymptomatic of dry eye.

### Inclusion criteria for group 2

All patients irrespective of age and sex, not suffering from diabetes mellitus

### Exclusion criteria:

- a) Type 1 diabetes mellitus, Cigarette smoking, Contact lens, Sjogren's syndrome, Rheumatoid arthritis, Parkinsonism, Patients on Drugs such as antihistamines, tricyclic antidepressants, oral

contraceptives, and Anti hypertensives, Vitamin A deficiency, Pregnancy, History of past ocular surgeries and ocular surface diseases, hyperthyroidism

- b) Patients not giving consent.

After taking informed consent, all patients were subjected to detailed examination according to a preset proforma.

1. Clinical data of all patients including age, duration of diabetes, history of other diseases obtained by reviewing the medical records and direct patient interview.
2. Fasting and PP blood sugar level.
3. Detailed history regarding symptoms of dry eye were taken.
4. Patients were subjected to ocular examination including:
  - a) Visual acuity
  - b) Slit lamp examination
  - c) Fundus examination with Indirect ophthalmoscope /90D
  - d) Tear film status with TBUT and Schirmer's test

Dry eyes were suspected on the basis of a history of ocular discomfort, including soreness, gritty sensation, itching, redness, blurred vision that improves with blinking and excessive tearing. The condition was confirmed by ocular surface dye staining pattern with fluorescein, tear film break up time (TBUT) and Schirmer test, according to American Academy of Ophthalmology by a specialist.<sup>[19]</sup> Diagnosis was established by positivity one or more of the tests (TBUT or Schirmer test).

Dry eye had one or more symptoms (often or all the time present) along with one or more positive clinical findings (based on slit lamp examination) and one or more positive clinical tests (tear break up time of  $\leq 10$  seconds, schirmer's test score  $\leq 10$ mm, with anesthesia  $\leq 5$ mm, fluorescein score of  $\geq 1$ ). Asymptomatic patients with positive signs or positive tests were also considered in the diagnosis. Dry eye was graded into three types-mild, moderate, and severe.

Slit lamp biomicroscopy examination was done and retinal status was evaluated by indirect ophthalmoscopy after dilation by Tropicamide drop. Diabetic retinopathy was graded according to early Treatment Diabetic Retinopathy (ETDRS) criteria.<sup>[13]</sup>

## **RESULTS**

The distribution of Dry Eye was compared between Diabetes and Non-diabetes groups using the Chi-square test. The distribution of Dry Eye was significantly more among Diabetes patients in comparison to non-diabetes.

**Table 1: Prevalence of Dry eye among Diabetes and Non-diabetes groups**

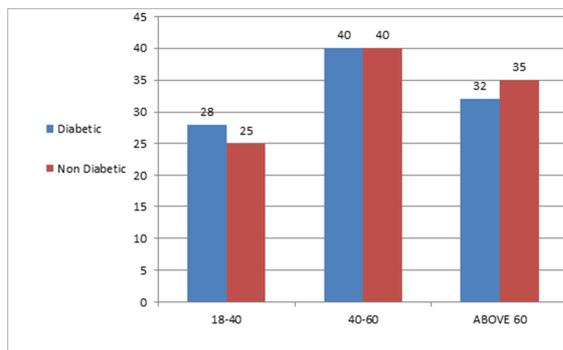
| Dry Eye | Diabetes | Non-diabetes | Total   |
|---------|----------|--------------|---------|
| Absent  | 32       | 73           | 105     |
|         | 32.0%    | 73.0%        | 52.5%   |
| Present | 68       | 27           | 95      |
|         | 68.0%    | 27.0%        | 47.5%   |
| Total   | 100      | 100          | 200     |
|         | 100.00%  | 100.00%      | 100.00% |
|         | 33.704   | 0.000        |         |

Chi-square test

\* Significant difference

**Table 2: Age wise distribution of patients in Group A and Group B.**

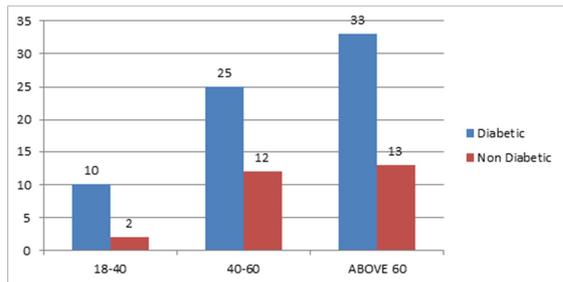
| Age Group (in years) | Diabetic | Non Diabetic |
|----------------------|----------|--------------|
| 18-40                | 28       | 25           |
| 40-60                | 40       | 40           |
| ABOVE 60             | 32       | 35           |



**Figure 1: Age wise distribution in Group A and B**

**Table 3: Age wise distribution of Patients having Dry eye in Group A and B**

| Age Group | Diabetic   | Non Diabetic |
|-----------|------------|--------------|
| 18-40     | 10 (14.7%) | 2 (7.4)      |
| 40-60     | 25 (36.7%) | 12 (44.4%)   |
| ABOVE 60  | 33 (48.5%) | 13 (48.1%)   |



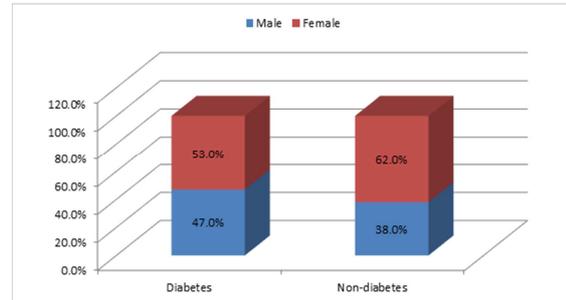
**Figure 2: Age wise distribution of patients having Dry eye in Group A and B**

The distribution of age in Dry Eye patients was compared between Diabetes and Non-diabetes groups using the Chi-square test. Dry Eye was seen more in Diabetes patients in comparison to Non Diabetic patients and was more commonly seen in the age group of above 60 years. This was found to be statistically significant ( $p < 0.001$ ).

There were 47 (47.0%) males and 53 (53.0%) females in the diabetes group. There were 41 (41.0%) males and 59 (59.0%) females in the non-diabetes group.

**Table 4: Gender wise Distribution in group A and B**

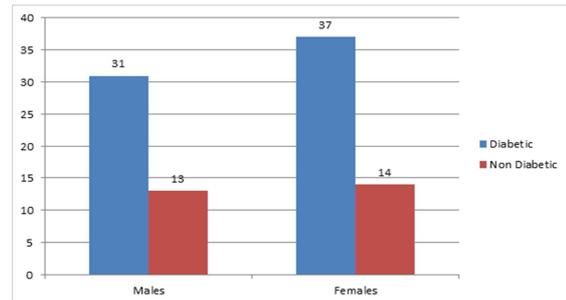
|        | Diabetes | Non-diabetes |
|--------|----------|--------------|
| Male   | 47       | 41           |
|        | 47.0%    | 41.0%        |
| Female | 53       | 59           |
|        | 53.0%    | 59.0%        |
| Total  | 100      | 100          |



**Figure 3: Gender wise Distribution in group A and B**

**Table 5: Gender wise distribution of Dry Eye patients in Group A and B**

| SEX     | Dry eye in Diabetic patients | Dry eye in Non-Diabetic patients |
|---------|------------------------------|----------------------------------|
| Males   | 31 (45.5%)                   | 13 (48.2%)                       |
| Females | 37 (54.5%)                   | 14 (51.8%)                       |



**Figure 4: Gender wise distribution of Dry Eye patients in Group A and B**

The distribution of sex in Dry Eye patients was compared between Diabetes and Non-diabetes group using the Chi-square test. The distribution of sex in Dry Eye patients was not statistically significant more among Diabetes patients in comparison to non-diabetes ( $p < 0.001$ ). P value = 0.821

**Table 6: Diabetic Retinopathy Grading**

| Diabetic Retinopathy Grading (Right) | Right eye | Left eye |
|--------------------------------------|-----------|----------|
| No Retinopathy                       | 60        | 60       |
| NPDR                                 | 22        | 24       |
| PDR                                  | 18        | 16       |
| Total                                | 100       | 100      |

**Table 7: Distribution of Dry eye in patients having NPDR & PDR**

|         | Dry eye in Right eye | Dry eye in Left eye |
|---------|----------------------|---------------------|
| NPDR    | 12                   | 14                  |
| PDR     | 18                   | 16                  |
| P<0.001 |                      |                     |

In diabetic patients, 20 patients each were having PDR and NPDR respectively whereas 60 patients

didn't have any retinopathy in the right eye and left eye.

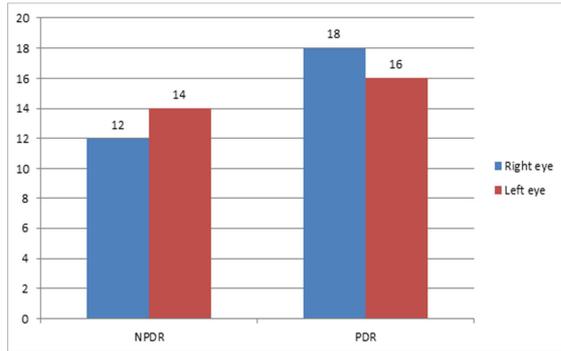


Figure 5: Distribution of Dry eye in patients having NPDR & PDR

Dry eye was seen in 60 eyes with diabetic retinopathy out of total 80 eyes with diabetic retinopathy. This was statistically significant  $p < 0.001$ .

It was also seen that dry eye was more commonly found in patients having PDR (34 out of 40).

Table 8: Ocular Symptoms in Group A and Group B

| Ocular Symptoms               | Group A | Group B |
|-------------------------------|---------|---------|
| 1. Feel dryness               | 68%     | 14%     |
| 2. Gritty and sandy sensation | 43%     | 7%      |
| 3. Burning sensation          | 86%     | 14%     |
| 4. Redness                    | 50%     | 14%     |
| 5. Stickiness                 | 42%     | 7%      |
| 6. Watery                     | 62%     | 21%     |
| 7. Crusty on lashes           | 21%     | 13%     |
| 8. Eyes got stunk shut        | 28%     | 7%      |

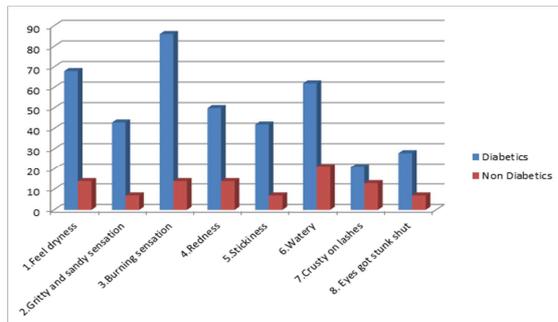


Figure 6: Ocular Symptoms in Group A and Group B

Table 9: Schirmer's test in Right eye in Group A and Group B

| Schirmer's test (Right eye) | Diabetics              | Non Diabetics |    |
|-----------------------------|------------------------|---------------|----|
| Normal (more than 10mm)     | 36                     | 79            |    |
| Dry Eye                     | Mild (5-10mm)          | 63            | 21 |
|                             | Moderate (2-5mm)       | 1             | 0  |
|                             | Severe (less than 2mm) | 0             | 0  |

Burning sensation (86%) and watering (21%) was seen as the most common ocular symptoms in Group A and Group B patients respectively.

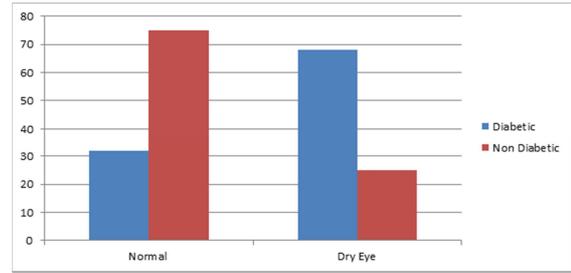


Figure 7: Schirmer's test in Right eye in Group A and Group B

Table 10: Schirmer's test in Left eye in Group A and Group B

| Schirmer's test (Left eye) | Diabetics              | Non Diabetics |    |
|----------------------------|------------------------|---------------|----|
| Normal (more than 10mm)    | 36                     | 71            |    |
| Dry Eye                    | Mild (5-10mm)          | 60            | 29 |
|                            | Moderate (2-5mm)       | 4             | 0  |
|                            | Severe (less than 2mm) | 0             | 0  |

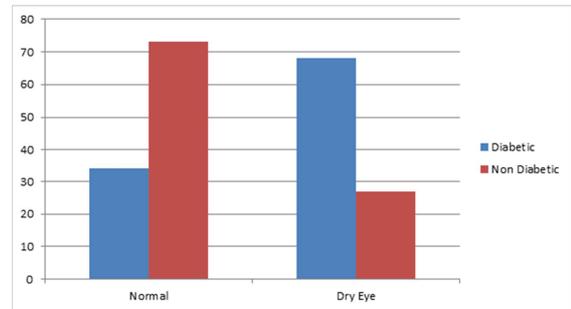


Figure 8: Schirmer's test in Left eye in Group A and Group B

Schirmer's test was positive for 128 eyes out of total 136 eyes having dry eye in diabetics which was statistically significant. ( $p < 0.001$ )

Table 11: Tear Film Break up Time in Right eye in Group A and Group B

| TBUT (Right eye)          | Diabetics               | Non Diabetics |    |
|---------------------------|-------------------------|---------------|----|
| Normal (more than 10 sec) | 32                      | 73            |    |
| Dry Eye                   | Mild (5-10sec)          | 66            | 27 |
|                           | Moderate (2-5sec)       | 2             | 0  |
|                           | Severe (less than 2sec) | 0             | 0  |

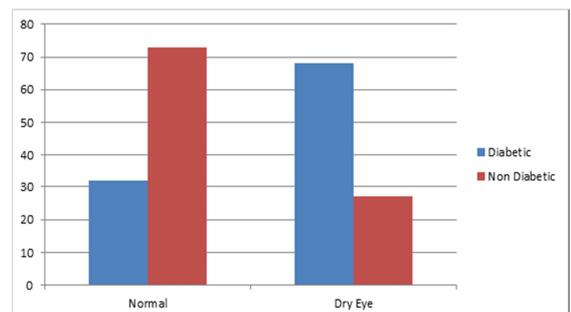
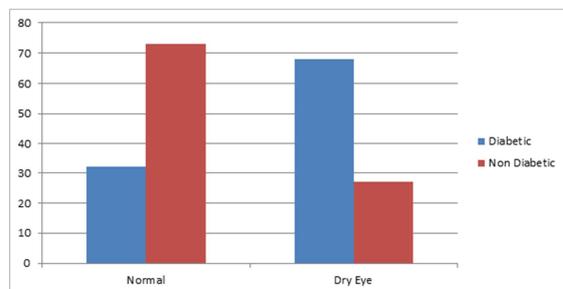


Figure 9: Tear Film Break Up Time in Right eye in Group A and Group B

**Table 12: Tear film Break Up Time in Left eye in Group A and Group B**

| TBUT (Left eye)          |                         | Diabetics | Non Diabetics |
|--------------------------|-------------------------|-----------|---------------|
| Normal(more than 10 sec) |                         | 32        | 73            |
| Dry Eye                  | Mild (5-10sec)          | 64        | 27            |
|                          | Moderate (2-5sec)       | 4         | 0             |
|                          | Severe (less than 2sec) | 0         | 0             |



**Figure 10: Tear film Break Up Time in Left eye in Group A and Group**

Tear Film Break Up Time was positive for all 136 patients having dry eye in diabetics which is statistically significant. (p=0.0001)

## DISCUSSION

In this study we had taken a sample of 100 cases of type 2 diabetes mellitus and simultaneously, a sample of 100 cases of patients not suffering from diabetes mellitus. The observations made in our study will be discussed here:-

In our study there were 28 diabetic patients and 25 non diabetic patients in the age group of 18-40 years, 40 diabetic patients and 40 non diabetic patients in the age group of 40-60 years and 32 diabetes mellitus patients and 35 non diabetic in the age group > 60 years. Mean age of the present study was found to be 53.4years. On assessing dry eye status we found that in the diabetic group, 14.7% in age group 18-40 years, 36.7% in the age group 40-60years and 48.5% patients in the age group greater than 60 years were suffering from dry eye. For non-diabetics the results of dry eye estimation were 7.4%, 44.4% and 48.1% in 18-40 years, 40-60 age group and more than 60 yrs age group respectively. The increased percentage of dry eye estimation in the older age group was probably due to age related eye lid alterations include lid laxity, meibomian gland atrophy and decrease in tear volume with increasing age especially after 60 years. So we found maximum frequency of dry eye in the age group above 60 yrs. In a similar study by K. Kalaivani et al,<sup>[14]</sup> 191 subjects of both sexes, with the mean age of 56.18± 8.87years, diagnosed with Type II Diabetes mellitus were studied. They classified their patients into three age groups 35-45 years (10.94%), 46-60years (60.21%) and >60years (28.80%) and found the presence of dry eye in 3.03% in age group 35-45

years, 47.47% in 46-60 years age group and 49.49% in >60 years of age group concluding that the frequency of dry eye was significantly high (49.49%) among age group >60years than other age groups. This was similar to the results in our study.

In our study there were 47 diabetic males and 53 diabetic females. We also had 41 non diabetic males and 59 non diabetic females. We found that 31 males and 37 females were suffering with dry eye in diabetic group. In non diabetic group 13 males and 14 females were having dry eye. The difference in frequency of dry eye between the two genders was not significant (p= 0.821). In a similar study by Krishnamoorthy Rathnakumar et al,<sup>[15]</sup> where they had 32 males and 68 female diabetic patients ,they found that 14 males (43.8%) and 39 females (57.4%) were suffering from dry eye which difference was not statistically significant like in our study. However, in a study by Hasan et al,<sup>[16]</sup> out of 48 diabetic males and 52 diabetic females, 21 males and similar number of females were having dry eye which suggests the percentage of males being higher than the females in this study. So there was no gender predilection found in our study or any other similar studies of frequency of dry eye in diabetics.

In our study ,we found that out of 100 diabetic cases, 68% were having dry eye while out of 100 non diabetic patients 27% were having dry eye where the p value is 0.0001 that shows it is statistically significant. Hence dry eye is more common in diabetics than non-diabetics.

In a similar study by Shaheen Banu et al,<sup>[17]</sup> they took 100 patients having non-insulin dependent diabetes in urban South Indian population those attended OPD at Ideal Diabetes Care Center. Dry eye were examined on the ground of history like ocular discomfort, soreness, gritty sensation, itchiness, redness, blurred vision which improves with blinking and excessive tearing. The status was proved with ocular surface dye staining pattern by fluorescein, TBUT and Schirmer test. All the patients were given lubricating eye drops (carboxy methylcellulose sodium eye drops).Out Of 100 patients of diabetes, 60 patients (60.0%) had dry eye syndrome. Another study by Mohammed Aljarousha et al,<sup>[18]</sup> took A group of 88 diabetic patients , age and gender matched with control subjects in a comparison study. They concluded that the percentage of dry eye syndrome symptoms was enough raised in diabetic subjects (15.9%) as compared with non-diabetic subjects (13.6%; p<0.001). The percentage of dry eye syndrome was much raised in diabetics with dry eye (63%) than in diabetics without dry eye (36.9%; p<0.001). So our study results were similar to these studies and showed dry eye significantly more in diabetics than non- diabetic patients.

In our study out of 100 patients ocular symptoms such as dryness 68%, grittiness 43%, burning sensation 86%, redness 50%, stickiness 42%,

watering 62%, crusting of lashes 21%, are much more higher in diabetic patients presented with dry eye than non diabetic patients. Similar results were also found by Dhar et al.<sup>[19]</sup> The presence of various symptoms of dry eye disorder were noted and scored according to the Mc Monnie's Dry Eye Questionnaire in this study. Foreign body sensation was majorly reported symptom whereas itching was the least reported symptom. All symptoms of dry eye, except itching, were found to be raised in patients with Diabetic Retinopathy as compared to patients without Diabetic Retinopathy. All signs of dry eye disorder were significantly more common in patients with Diabetic retinopathy as compared to patients without Diabetic Retinopathy.

In our study TBUT was deranged in 68% diabetics and 27% non-diabetics. The p value is 0.0001 which shows that there is a statistically significant difference in the number of patients with deranged TBUT in diabetic and non diabetic group. According to DEW 2007 grading , out of the 68% diabetics with dry eye, 96.3% had mild dry eye and 3.7% had moderate dry eye, while all the non diabetics had mild dry eye.

In a similar study by Silviana S. Kamel et al,<sup>[20]</sup> TBUT values were less in the uncontrolled diabetic patients. Amongst 50 diabetic patients 15 were normal and 35 had dry eye, out of which 54.2% had mild dry eye, 28.5% had moderate dry eye and 17.3% presented with severe dry eye. While in 50 non-diabetics only 10 patients had dry eye out of which 70% had mild dry eye and 30% had moderate dry eye.

In our study schirmer's test was positive in 64% in diabetics and 25% in non-diabetics in 200 diabetic and non-diabetic eyes. 128 were positive for schirmer's in diabetics out of which 98.4% had mild dry eye and 1.2% had moderate dry eye according to DEW 2007 grading whereas all the non diabetic patients were having mild dry eye. In another study by Hasan et al,<sup>[16]</sup> they took 100 diabetic patients 33 patients were TBUT positive and 16 were positive for Schirmer's test . In another study by Pai Shobha G et al they stated that about 50% cases were dearrange for schirmers in diabetics while the figure goes 42% for dearranged cases of schirmers respectively in non-diabetics. The p value comes to be 0.0001 which shows it is significant schirmer's test will be dearranged in dry eye patients So in our study we found that TBUT and Schirmer's will be deranged in the patients of dry eye.

In our study ,we found that out of 100 diabetic patients 40 patients were having diabetic retinopathy and rest 60 had no diabetic changes .Out of 80 eyes of these 40 patients,60 eyes (75%) were diagnosed as dry eye in which 56.6% had PDR and 43.3% had NPDR. In our study we found ( $p > 0.001$ ) so it is statistically significant that diabetic retinopathy patients had higher frequency of dry eye than non diabetic retinopathy patients. This concludes that the

risk of dry eyes is much more in the patients having diabetic retinopathy as compared to diabetic patients with no diabetic retinopathy.

In a similar study by Tanushree v et al,<sup>[21]</sup> where they took 100 diabetic patients, 56 (56%) patients had Diabetic retinopathy and 46(46%) had normal fundus picture. Out of the 56, 34 (60.71%) patients had mild NPDR, 10 (17.85%) patients had moderate NPDR, 10(17.85%) patients had severe NPDR and 2 (3.57%) patients had PDR. Out of the 100 patients, 36 (36%) patients had dry eye. 4 (11.11%) patients with normal fundus, 16 (44.44%)patients of mild NPDR, 8 (22.22%) patients of moderate NPDR, 6 (16.67%) patients of severe NPDR and 2 (5.56%) patients of PDR had dry eye .This shows a significant association between dry eye and diabetic retinopathy. So in our study we found that frequency of dry eye is significantly more in patients with diabetic reitionopathy than patients with non diabetic retinopathy.

## CONCLUSION

It has been proved that dry eye have high frequency with diabetics. There this can be concluded that diagnosis for dry eye by TBUT and Shirmer's along with history of ocular symptoms can be utilized as screening tool. Due to Diabetes, dry eye will appear in higher age groups. In other words, in a person with Diabetes, dry eye may manifest in higher age group as compared to person non diabetes.Due to Diabetes, chances of occurring dry eye in more in females as compared to males.Frequency of dry eye is much higher in Diabetic having diabetic retinopathy as compared to diabetics of non diabetic retinopathy group.

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