

Prevalence of Dry Eye Syndrome and Diabetic Retinopathy in type 2 Diabetic Patients

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Abstract

Aims: This study was performed to assess the prevalence of dry eye syndrome and diabetic retinopathy (DR) in type 2 diabetic patients and their contributing factors.

Materials and Methods: 90 type 2 diabetic patients referred to the Department of Ophthalmology Veer Chandra Singh Garhwali Government Institute of Medical Science and Research, Srinagar, Pauri Garhwal, Uttarakhand, between December 2022 and February 2023 were consecutively selected. All patients were asked about other diseases and drugs. Dry eye syndrome was assessed with TBUT tests and Schirmer. Indirect and direct ophthalmoscopy were done for all the cases. Diabetic Retinopathy was graded according to early Treatment Diabetic Retinopathy (ETDRS) criteria.

Results: Of 90 subjects, 48 patients (54.88%) suffer from dry eye syndrome. Although dry eye syndrome was more common in older and female patients, this association was not significant. But there was significantly association between dry eye syndrome and duration of diabetes. Diabetic Retinopathy was found in 64 patients (71.11%) of which 15 (16.67%) patients had mild NPDR, 13 (14.44%) had moderate & 7(7.88%) had severe NPDR. PDR was seen in 29(32.22%) patients.

Conclusions: In this study the prevalence of dry eye syndrome was 54.88%. Diabetes and dry eyes appear to have a common association. Further studies need to be undertaken to establish an etiologic relationship. However, examination for dry eye should be an integral part of the assessment of diabetic eye disease.

Keywords: Dry eye, Diabetic retinopathy, Prevalence

Introduction

Total diabetic population in the world is about 463 million in 2019(1). Diabetes is one of the common cause of blindness in persons aged 20–70 years(2).The most common is type 2 diabetes in adults, which occurs when the body is resistant to insulin or doesn't make enough insulin. Well known ocular complications of diabetes are Cataract and retinopathy(3). The common etiology of blindness in persons aged 20–70 year is diabetes(2). The HBA1c values and the presence of dry eye syndrome has a co relation. If the HBA1c values are high, then the rate of dry eye syndrome is high(4). Tear film consists of three layers: outer lipid layer that prevents evaporation from eye surface, middle aqueous made of mainly water and inner

mucus layer. Pathological and clinical signs of dry eye syndrome are more than symptoms in patients with diabetic retinopathy(5). In severe DED, tear film dysfunction aggravates the ocular surface, which induces a corneal epithelial defect, leading to secondary bacterial infection, corneal ulcers leading to visual impairment.

Material & Methods

A cross sectional study was conducted in the Department of Ophthalmology, Veer Chandra Singh Garhwali Government Institute of Medical Science and Research, Srinagar, Pauri Garhwal, Uttarakhand India from January 2022 to February 2022. Entire subjects signed an informed consent approved by institutional ethical committee of VCSG GIMS & R Srinagar was sought. A total of 130 patients with T2DM was taken for study.

Inclusion criteria:

Type 2 DM patients who were willing to participate in the study and whose age is more than 30 years were included.

Exclusion criteria:

Patients whose fundus is not seen due to any reason, contact lens users, any ocular surgery in the past six months, patients on systemic or local medication which can cause dry eye such as topical antiglaucoma medications, beta blockers, diuretics, anticholinergics, anti-histaminic, tricyclic antidepressants(6), oral contraceptive pills, patients with ocular adnexal, conjunctival or corneal pathologies and systemic diseases which cause dry eye like Sjogren's syndrome, Allergies, Parkinson, SLE, Rheumatoid Arthritis(7), pregnant women(8) were excluded from the study.

Data Collection methods:

By staining the tear film using a fluorescein strip without using topical anesthesia TBUT test was performed. Patient was asked to blink for few seconds. Tear film was visualized using Cobalt blue filter. The time between the last blink and the appearance of the first corneal dry spot in the stained tear film was recorded. Abnormal TBUT value was <10 s.

Using standardized Whatman filter paper, Shirmer test was performed without topical anesthesia. The strip was placed in the lower fornix at the junction of middle and lateral third of lid margin after folding at 90 degrees at 5mm for 5 min. The amount of wetting was measured in millimeter. The measurement >15mm was taken as Normal. Grading of dry eye: Mild Dry Eye 10- 15 mm, Moderate Dry Eye 5-10mm, Severe Dry Eye <5mm. Visual Acuity by Snellen chart, slit lamp examination, Fundus examination by Direct and Indirect Ophthalmoscope was performed.

Statistical Analysis:

For the purpose of statistical analysis, Statistical Product and Service Solutions (SPSS version 26) software package for Windows, Student Edition used. Standard deviations, mean actual ages, frequencies for each group will be calculated and will be used to analyze the data in this study using Chi square test, Student t test and P value for statistical significance testing. A *p* value < 0.05 was accepted as statistically significant.

180 eyes of 90 diabetic patients were assessed in our study. 35 subjects were more than 60 years, 22 were between 40 and 60 and 33 were less than 40 years of age. The mean

(\pm standard deviation) age of Diabetic patients was 53.25 ± 14.56 years (Range 30 to 75 years). 51 were Males (age 54.38 ± 14.51 years) and 39 were Females (age 51.48 ± 14.66 years) in total 90 diabetic patients. Out of 90 subjects 48 patients (53.33%) had dry eyes of which 20(41.67%) were female and 28(58.33%) were male.

Among the 48 dry eyes patients, mild dry eye was seen in 33 (69%) patients, moderate dry eye was seen in 6(13%) patients and severe dry eye was seen in 9(19%) patients. Mean (SD) HbA1c level of all dry eye group was 8.85 (0.96) & for no dry eye group was 8.08 (0.85). Among dry eye patients, 3 (6.25%) patients had HbA1c < 7.5, 14 (29.16%) patients had HbA1c between 7.50 -8.50 and 31 (64.58%) patients had HbA1c >8.5. Among no dry eye patients, 6(14.28%) patients had HbA1c < 7.5, 26 (61.90%) patients had HbA1c between 7.50 -8.50 and 10 (23.80%) patients had HbA1c > 8.5.

Diabetic retinopathy was found in 64 (71.11%). Among total diabetic patients,15 (16.67%) patients had mild NPDR, 13 (14.44%) had moderate & 7(7.88%) had severe NPDR. PDR was seen in 29(32.22%) patients

Table I: Distribution of study participants according to age (n=90)

Current age (in years)	Dry Eye		No Dry Eye	
	N	%	N	%
<40	8	16.67	25	59.52
41-60	10	20.83	12	28.57
>61	30	62.50	5	11.91
Total	48	100.0	42	100.0
<i>Mean (SD)</i>	<i>54.58 (15.25)</i>		<i>51.78 (13.7)</i>	

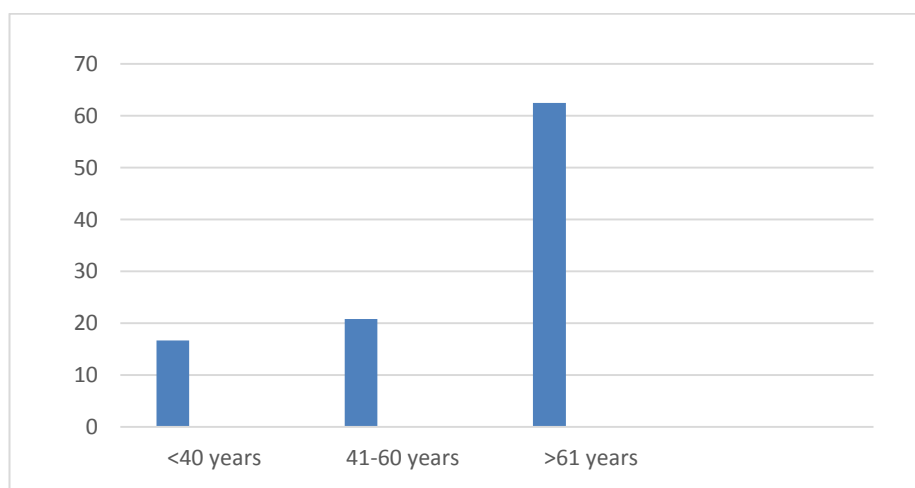


Fig-1: Percentage of dry eye in different age group

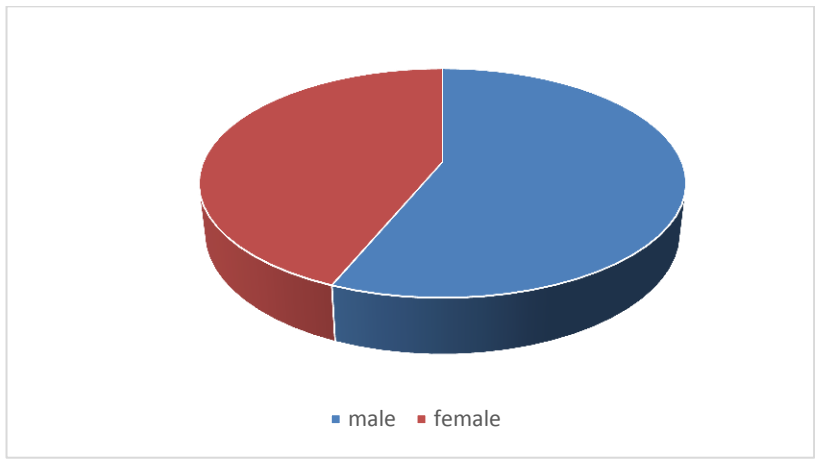


Fig-2: Gender distribution of Diabetic patients

Table II: Distribution of study participants according to sex and their ages (n=90)

Gender	Diabetics	%	Age in yrs
Male	51	56.67	54.38 ± 14.51
Female	39	43.33	51.48 ± 14.66

Table-III: Distribution of study participants HbA1c level (n=90) HbA1c Level

	Dry Eye		No Dry Eye	
	N	%	N	%
<7.50	3	6.25	6	14.28
7.50-8.50	14	29.16	26	61.90
>8.50	31	64.58	10	23.80
Total	48	100.0	42	100.0
Mean (SD)	8.85 (.96)		8.08 (.85)	

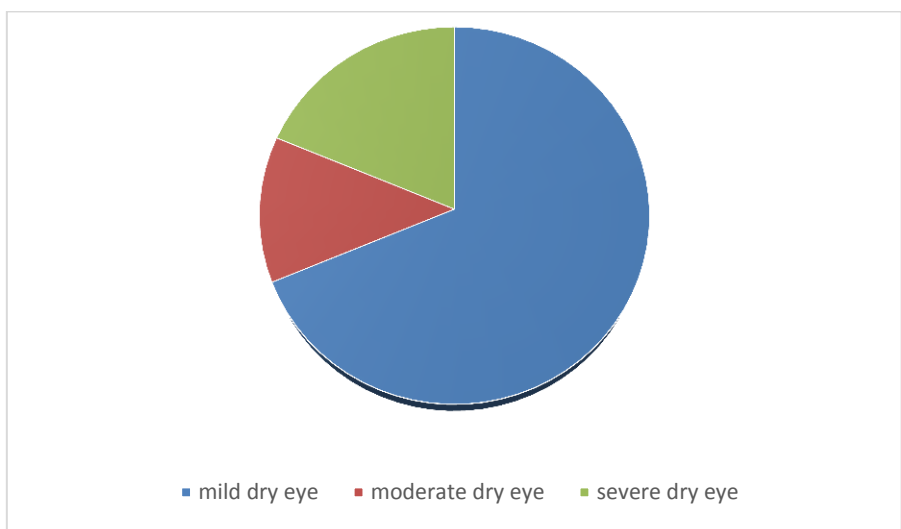


Fig-3: Grades of dry eye

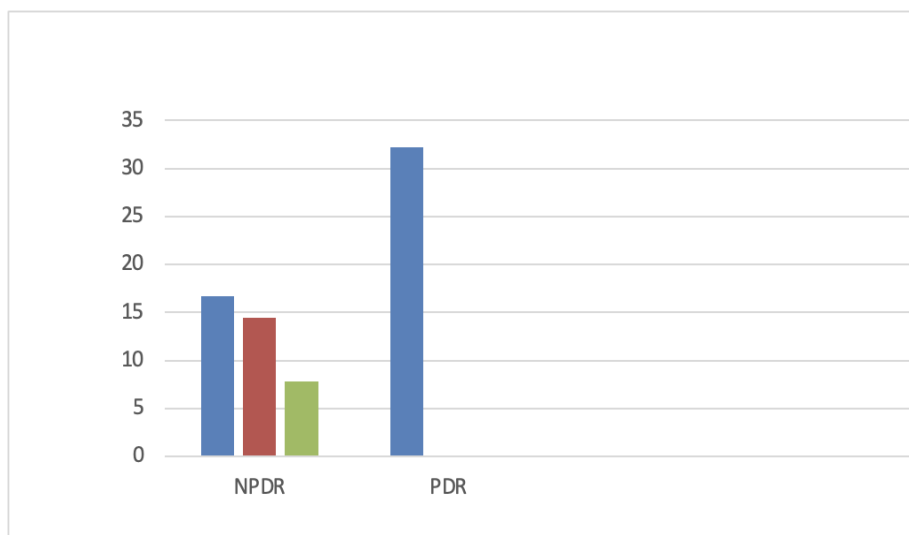


Fig-4: Prevalence of diabetic retinopathy in type 2 diabetic patients

Discussions

Dry eye syndrome and diabetic retinopathy seems to have a common relationship. Diagnosis of dry eye syndrome was based on diagnostic tests which included TBUT test, Shirmer test, symptoms and signs.

If patients had uncontrolled diabetes and for a longer duration, the chances of dry eye disease increases(9). Autonomic neuropathy affects tear gland which in turn affect tear production causing dry eyes. So, we should keep our blood glucose under strict control.

Prevalence of dry eye in our study was 53.21% which was similar to study by Seifart u and Stempel(4). Dry eye was diagnosed in 45.6% by the study of Khetwani D and Karambelkar VH(10). According to study by Kaiserman, prevalence of dry eye is more in older age(11). Melbourne study also found higher prevalence of dry eye in older age people(12). There is decrease in tear volume and flow and increase in evaporation in older age(13). Increase in tear film osmolarity and evaporation with age is also a risk factor for dry eye in older age(14). Reduced corneal sensitivity, abnormalities of tear film dynamics, the lacrimal gland microvasculature damage and meibomian gland dysfunction can also lead to increased prevalence of dry eye disease in diabetic patients.

After grading the dry eye, according to Schirmer's test our study showed that 68.75% patients had mild, 12.50% had moderate and 18.75% patients had severe dry eye. Total male and female affected were 56.67% and 43.33% which was similar to study done by Lee *et al* (15). But according to study by Moss *et al.* in 2000 reported a higher incidence of dry eye syndrome in type-2 diabetic women(16)(17).

There is a complex link between sex hormones and dry eye. Dry eyes can be treated with topical estrogen in menopausal women while androgen help in regulating aqueous and lipid component of tears (18). Piera Versura and Emilio c campos study also established the relationship of dry eye with sex hormones(19).

Lifestyle modifications like quitting smoking and other things which irritate eyes may help the people with dry eye. Artificial tears eyedrops like carboxy methyl cellulose and procedure

which block tear drainage can be used to get relief from symptoms of dry eye(20). Air Humidification may ease dry eye symptoms.

Conclusions

There is a statistically significant correlation between diabetic retinopathy and dry eye syndrome with type 2 DM. Our study shows that diabetics patients have increase prevalence of dry eye syndrome. DED in patients with DM is associated with female sex, old age and poor diabetic control. Further studies need to be done to find out the etiological relationship. However, every diabetic patient coming to eye OPD should be asked for dry eye syndrome.

References

1. Sun H, Saeedi P, Karuranga S, Pinkepank M, Ogurtsova K, Duncan BB, et al. IDF Diabetes Atlas: Global, regional and country-level diabetes prevalence estimates for 2021 and projections for 2045. *Diabetes Research and Clinical Practice*. 2022 Jan;183:109119.
2. Kesarwani D, Rizvi SA, Khan A, Amitava A, Vasenwala S, Siddiqui Z. Tear film and ocular surface dysfunction in diabetes mellitus in an Indian population. *Indian J Ophthalmol*. 2017;65(4):301.
3. Manaviat MR, Rashidi M, Afkhami-Ardekani M, Shoja MR. Prevalence of dry eye syndrome and diabetic retinopathy in type 2 diabetic patients. *BMC Ophthalmol*. 2008 Dec;8(1):10.
4. Seifart U, Stempel I. [The dry eye and diabetes mellitus]. *Ophthalmologe*. 1994 Apr;91(2):235–9.
5. Nielsen NV, Lund FS. Diabetic polyneuropathy. Corneal sensitivity, vibratory perception and Achilles tendon reflex in diabetics. *Acta Neurologica Scandinavica*. 1979;59(1):15–22.
6. Khurana G. Dry Eye in Patients With Diabetic Retinopathy: A Clinical Study. DJO [Internet]. 2017 Jan 1 [cited 2023 Feb 9];27(3). Available from: <http://www.djo.org.in/articles/27/3/dry-eye-in-patients-with-diabetic-retinopathy-a-clinical-study.html>
7. Kosrirukvongs P, Ngowyutagon P, Pusuwan P, Koolvisoot A, Nilganuwong S. Prevalence of Dry Eye Syndrome and Sjogren's Syndrome in Patients with Rheumatoid Arthritis. 2012;95.
8. Schechter JE, Pidgeon M, Trousdale MD, Changl N. POTENTIAL ROLE OF DISRUPTED LACRIMAL ACINAR CELLS IN DRY EYE DURING PREGNANCY.
9. Naik K, Magdum R, Ahuja A, Kaul S, S J, Mishra A, et al. Ocular Surface Diseases in Patients With Diabetes. *Cureus*. 2022 Mar;14(3):e23401.
10. Khetwani D, Karambelkar VH, Gadre GA. Ocular Surface Disorders in Type 2 Diabetes Mellitus. *IJCMR [Internet]*. 2019 Mar [cited 2023 Feb 10];6(3). Available from: https://www.ijcmr.com/uploads/7/7/4/6/77464738/ijcmr_2395.pdf
11. Kaiserman I, Kaiserman N, Nakar S, Vinker S. Dry eye in diabetic patients. *American Journal of Ophthalmology*. 2005 Mar 1;139(3):498–503.
12. McCarty CA, Bansal AK, Livingston PM, Stanislavsky YL, Taylor HR. The epidemiology of dry eye in Melbourne, Australia. *Ophthalmology*. 1998 Jun;105(6):1114–9.
13. Mathers WD, Lane JA, Zimmerman MB. Tear film changes associated with normal aging. *Cornea*. 1996 May;15(3):229–34.

14. Gilbard JP. Human tear film electrolyte concentrations in health and dry-eye disease. *Int Ophthalmol Clin.* 1994;34(1):27–36.
15. Lee R, Wong TY, Sabanayagam C. Epidemiology of diabetic retinopathy, diabetic macular edema and related vision loss. *Eye and Vis.* 2015 Dec;2(1):17.
16. Moss SE. Prevalence of and Risk Factors for Dry Eye Syndrome. *Arch Ophthalmol.* 2000 Sep 1;118(9):1264.
17. 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. *Front Med (Lausanne).* 2022;9:980714.
18. Sator MO, Joura EA, Golaszewski T, Gruber D, Frigo P, Metka M, et al. Treatment of menopausal keratoconjunctivitis sicca with topical oestradiol. *BJOG: An International Journal of Obstetrics & Gynaecology.* 1998;105(1):100–2.
19. Versura P, Campos EC. Menopause and dry eye. A possible relationship. *Gynecological Endocrinology.* 2005 May 1;20(5):289–98.
20. Dibajnia P, Akhgary M, Aghazade-Amiri M, Keikhayfarzaneh MM. Tear Film Break-Up Time: Comparison between Patients using Psychiatric Drugs and Heal.