ORIGINAL RESEARCH PAPER

Volume-8 | Issue-4 | April-2019 | PRINT ISSN No 2277 - 8179

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

# DRY EYE SYNDROME AND DIABETES: A BRINY AND SACCHARIFEROUS CHRONICLE.

Ophthalmology

**Meenakshi Pathania** — Graded Specialist, Department of Ophthalmology, Military Hospital, Wellington, Tamil Nadu, India

**Varun Bajaj*** — Graded Specialist, Department of Pathology, Military Hospital, Wellington, Tamil Nadu, India *Corresponding Author

**Pankaj P Rao** — Commandant, Military Hospital, Wellington, Tamil Nadu, India

## ABSTRACT

**Background:** Amongst the bothersome sequelae of Diabetes mellitus, Dry Eye Syndrome (DES) appears to frequent the most. A poor glycaemic control through its sinister pathophysiology underlies this complication.1 As per the International Diabetes Federation most cases of Diabetes exist in China followed closely by India and the United states. 2 Studies show a prevalence of 54% of DES in Diabetics.3 The authors aim to study the association of markers like reduced Tear break up time and decreased Schirmer's test value which herald this complication in Diabetics with the subjects glycaemic control estimated by HbA1C values.

**Method:** 50 patients with diagnosed Diabetes Mellitus type 2 and 50 non diabetic controls underwent HbA1c level, Tear Break Up Time (TBUT) estimation and Schirmer's test after informed consent.

**Results:** A statistically significant reduction in the tear film break up time and Schirmer's value were found in the diabetic group as compared to the control group. It was also found that the TBUT and Schirmer's test values deteriorate further with increase in HbA1c levels.

**Conclusion:** There is a strong evidence of relationship between long term glycaemic control and dry eye syndrome among diabetic patients.

## KEYWORDS

Dry eye, HbA1c, TBUT, Schirmer's test

## INTRODUCTION

Diabetes Mellitus is accompanied by microvascular complications and is one of major causes of blindness in adults. [4,5] Whilst Diabetic Retinopathy (DR) and Diabetic cataracts have an established causality, Dry Eye Syndrome (DES) for all its benignity is also common in diabetics.[6] Dry eye per say is a precorneal tear film disorder caused by tear deficiency or excessive evaporation resulting in ocular discomfort due to surface damage. DES in Diabetes can be of tear deficient or evaporative variety. [7] About 5% of Indian urban people are affected by Diabetes Mellitus Type 2.[8,9] Different studies have reported the dry eye prevalence in diabetic patients between 14.4% to 54.3%.[10-15]

Diabetic patients usually have classic dry eye symptoms like irritation, burning, itching, redness, pain, foreign body sensation as well as Schirmer's test abnormalities.[16]

A host of factors compounded by the hyperosmolar and hyperglycaemic state culminate in the dysfunction of the Lacrimal Functional Unit (LFU) which is pivotal in the development of the said syndrome. In Diabetes the corneal epithelium tends to be suboptimal functionally and this propensity increases with an increasing HbA1c.[17] In animal models increased amounts of glucose, glycogen and sorbitol have been demonstrated cementing the correlation between LFU dysfunction, hyperglycaemia and sorbitol pathway activation. [18] Other mechanisms involved are activation of aldose reductase leading to cellular oedema and dysfunction, Decreased mucin production due to destruction of goblet cells, poor autonomic control over tear production due to neuropathy and decreased tear film thickness.[19,20,21] HbA1c levels are related to mean blood glucose levels over a long time and are not affected by daily fluctuations in concentration of blood glucose value but average level of glucose of six to eight week period. So, HbA1c is an important indicator of contemporary blood glucose level.

## MATERIAL AND METHODS

The study was conducted in a peripheral Military hospital. 50 known cases of diabetes mellitus type2 of age interval 30-60 years were selected along with age matched 50 non-diabetic controls who came for routine check-up. The informed consent was obtained from all the subjects.

### Inclusion Criteria

1. All cases of Diabetes Mellitus type 1 and type 2 undergoing active monitoring with HbA1c periodically.
2. Freshly detected Diabetes during Annual or Periodic medical examination were included to be prospectively monitored.

### Exclusion criteria

1. History of current use of systemic or topical use of beta blockers, lubricants, diuretics, antihistaminic.
2. Ocular disorders like blepharitis, allergic conjunctivitis
3. Recent trauma or ocular surgery in past 6 months
4. Contact lens wear or LASIK surgery
5. Cigarette smoking
6. Pregnant females or Cases of Gestational Diabetes were excluded to homogenise the case and control groups.
7. Patients with known connective tissue disorders particularly Sjogren syndrome were excluded and suspicious cases investigated for ANAs and excluded.

Fasting blood sample was tested for estimation of HbA1c level by 'Particle Enhanced Immunoturbidimetric method' in both the Diabetic and Non-Diabetic group. The data was plotted along with age, sex and duration from diagnosis/Onset of therapy.

Concurrently, Fluorescein was instilled in the conjunctival sac and examined under cobalt blue filter and the TBUT was calculated.

This was followed by a Schirmer's test with Whatman filter paper No. 41 under the same environmental conditions.

All data was analysed using Microsoft excel and XPSS version 10 for windows.

The diabetic group was further stratified into three groups based on HbA1c level.

1. Group 1 consisted of patients having HbA1c value between 7%-8%.
2. Group 2 consisted of patients having HbA1c levels between 8%-10%.
3. Group 3 consisted of patients having HbA1c levels of above 10%.

The Control group had HbA1c level equal to or less than 7%.

The TBUT and Schirmer's values were compared in the case and control group. HbA1c values in the diabetic group were plotted against the above values to investigate for correlation.

## RESULTS

The mean TBUT value in controls 13.74$\pm$3.24 sec was significantly higher as compared to diabetic group 7.26$\pm$3.42 sec. (Table 1)

The Schirmer's test value in controls 14.04$\pm$7.24 sec was significantly

higher as compared to diabetic group 10.22±4.21 sec as well. (Table 1) It was observed that the TBUT and Schirmer's test values decreased from group 1 to group 3 suggesting an inverse relationship between HbA1c and the above parameters. (Table 2 and 3).

**Table1: TBUT (sec) and Schirmer's test (mm/5min) comparative values in case and control groups.**

| | Controls (50) (Non-Diabetics with HbA1c < 7%) | Diabetic group (50) (with HBA1c >7%) | P value |
|---|---|---|---|
| TBUT (sec) | 13.74+3.24 | 7.26+3.42 | P<0.05 |
| Schirmer's test (mm/5min) | 14.04+7.24 | 10.22+4.21 | P<0.05 |

*Students Paired t- test.*

**Table2: TBUT in diabetic patients (Mean+/-SD)**

| Group | HbA1c | No. of patients | TBUT (sec) |
|---|---|---|---|
| 1 | 7%-8% | 26 | 9.12+2.21 |
| 2 | 8%-10% | 18 | 7.28+1.14 |
| 3 | >10% | 6 | 6.09+1.04 |

**Table3: Schirmer's test value in diabetic patients (Mean+/- SD)**

| Group | HbA1c | No. of patients | Schirmer's test |
|---|---|---|---|
| 1 | 7%-8% | 26 | 10.89+ 1.90 |
| 2 | 8%-10% | 18 | 9.08+1.24 |
| 3 | >10% | 6 | 8.89+1.10 |

## DISCUSSION

In the present study the diabetic group has shown a significant reduction in the TBUT and Schirmer's values with both parameters being significantly reduced which proves the point that diabetic patients are more susceptible to dry eyes as mentioned in different studies.[10,14]

With an increase in HbA1c level, there was a decrease in the mean values of TBUT and Schirmer's test. Our results were comparable to studies by Gekka et al which showed a decreasing LFU function with increasing HbA1c levels owing to corneal epithelial abnormalities.[17] Studies by Goebbels et al showed a reduction of 37% in the Schirmer's values in the case vs the control group, in our study this reduction was 27%.[16] This study shows that there is a qualitative and quantitative reduction in the tear film activity with increase in HbA1c level in diabetic patients.

A complex pathophysiology forms the centre piece of the puzzle. A state of chronic hyperglycaemia heralds osmolarity disturbances and procreates a state of inflammation. Studies have demonstrated increased amounts of Advanced Glycation End products (AGEs) and a host of inflammatory mediators in the LFU mileu.[22] Devotedly colluding with the inflammation are neuropathy, vasculopathy and decreased insulin, all of which augment the LFU dysfunction by partially understood mechanisms.

HbA1c is glycated haemoglobin whose level reflects the average blood glucose level over previous four weeks to three months and provides a much better indication of glycaemic control as compared to blood or urinary glucose determination. Determination of Hba1c has been crowned near ideal in all the latest diagnostic criteria due to high specificity, low intra individual variation and a feeble variation amongst different ethnic groups.[23] In the Diabetes Control and Complications trial, data was suggestive of reduction in the risk of DR by 76%, microalbuminuria by 39% and neuropathy by 60% over 6 years as Hba1c dropped from 9% to 6%. Such definitive correlation hasn't been observed for other glycaemic indices. This study shows that poor long-term glycaemic control can contribute to qualitative and quantitative reduction in tear film activity as indicated by TBUT and Schirmer's test akin to a study by Seifart et al.[24] However Hba1c too suffers from erroneous values and should be interpreted with care in patients with Haemoglobinopathies.

## CONCLUSION

In this study a significant correlation has been found between increase in HbA1c level and quantitative and qualitative reduction of tear film activity which means that there are more chances of dry eye if there is a poor glycaemic control. Thus among the diabetic patients, an increase in HbA1c level is an important predictor of dry eye syndrome and so examination for dry eyes should be done in diabetics with poor blood glucose control.

## REFERENCES


1. Zhang X, Zhao L, Deng S, Sun X, Wang N. Dry Eye Syndrome in Patients with Diabetes Mellitus: Prevalence, Etiology, and Clinical Characteristics. Journal of Ophthalmology. 2016;2016:8201053. doi:10.1155/2016/8201053
2. Xu Y, Wang L, He J, Bi Y, Li M, Wang T, Wang L, Jiang Y, Dai M, Lu J, Xu M, Li Y, Hu N, Li J, Mi S, Chen CS, Li G, Mu Y, Zhao J, Kong L, Chen J, Lai S, Wang W, Zhao W, Ning G, 2010 China Noncommunicable Disease Surveillance Group
3. Manaviat M. R., Rashidi M., Afkhami-Ardekani M., Shoja M. R. Prevalence of dry eye syndrome and diabetic retinopathy in type 2 diabetic patients. BMC Ophthalmology. 2008;8, article 10 doi: 10.1186/1471-2415-8-10.
4. Writing Team for the Diabetes Control and Complications Trial/Epidemiology of Diabetes Interventions and Complications Research Group. Effect of intensive therapy on the microvascular complications of type 1 diabetes mellitus. JAMA 2002;287:2563-9.
5. Harrison TR: Diabetes Mellitus. In Harrison Principle of Internal Medicine 15th edition. Branwald E, Fauci S, Kasper D, Hauser LS, L Longo D, Jameson JL, editors. USA, Mc Grow-Hill; 2001. p. 2121.
6. Manaviat M. R., Rashidi M., Afkhami-Ardekani M., Shoja M. R. Prevalence of dry eye syndrome and diabetic retinopathy in type 2 diabetic patients. BMC Ophthalmology. 2008;8, article 10 doi: 10.1186/1471-2415-8-10.
7. R.L.McKown,N.Wang,R.W.Raabetal.,"Lacritin and other new proteins of the lacrimal functional unit,"Experimental Eye Research,vol.88,no.5,pp.848–858,200
8. Mohan V, Shanthi Rani S, Deepa R, Premlatha G, Sastry NG, Saroja R. Intraurban differences in the prevalence of the metabolic syndrome in southern India – The Chennai Urban Population Study. Diabet Med 2001; 18:280-87.
9. Ramachandran A, Snehlatha C, Dharmaraj D, Viswanathan M. Prevalence of glucose intolerance in Asian Indians. Urban rural difference and significance of upper body adiposity. Diabetes Care 1992; 15:1348-55.
10. Manaviat M. R., Rashidi M., Afkhami-Ardekani M., Shoja M. R. Prevalence of dry eye syndrome and diabetic retinopathy in type 2 diabetic patients. BMC Ophthalmology. 2008;8, article 10 doi: 10.1186/1471-2415-8-10.
11. Jin J, Chen LH, Liu XL, Jin GS, Lou SX, Fang FN. Tear film function in non insulin dependent diabetics. Zhonghua Yan Ke Za Zhi. 2003;39(1):10-3.
12. Seifart U, Strempel I. The dry eye syndrome and diabetes mellitus. Ophthalmologe. 1994;91(2):235-9.
13. Sendecka M, Baryluk A, Polz-Dacewicz M. [Prevalence of and risk factors for dry eye syndrome]. Przegl Epidemiol. 2004,58(1):227-33. Polish.
14. Moss SE, Klein R, Klein BE. Incidence of dry eye in an older population. Arch Ophthalmol. 2004;122(3):369-73.
15. Jain S: Dry eyes in diabetes. Diabetes Care 1998, 21(8):1364-1382.
16. Goebbels M. Tear secretion and tear film function in insulin dependent diabetics. Br J Ophthalmol. 2000;84(1):19-21.
17. M.Gekka,K.Miyata,Y.Nagaietal.,"Corneal epithelial barrier function in diabetic patients," Cornea, vol. 23, no. 1, pp. 35–37, 2004.
18. J.Friend,T.C.Kiorpes,and R.A.Thoft,"Diabetes mellitus and the rabbit corneal epithelium,"Investigative Ophthalmology and Visual Science,vol.21,no.2, pp. 317–321, 1981.
19. Ramos-Remus C, Suarez-Almazor M, Russell AS. Low tear production in patients with diabetes mellitus is not due to Sjogren's syndrome. Clin Exp Rheumatol. 1994;12:375–380
20. S. C. G. Tseng, L. W. Hirst, and A. E. Maumenee, "Possible mechanisms for the loss of goblet cells in mucin-deficient disorders,"Ophthalmology,vol.91,no.6,pp. 545–552, 1984.
21. M. Nakata, Y. Okada, H. Kobata et al., "Diabetes mellitus suppresses hemodialysis-induced increases in tear fluid secretion,"BMC Research Notes,vol.7,no.1,article78, 2014.
22. W.Stevenson,"Dry eye disease,"Archives of Ophthalmology ,vol. 130,no.1,pp.90–100, 2012.
23. Anand SS, Malmberg K, Razak F, Yi QL, Vuksan V, Teo KK et al. Diagnostic strategies to detect glucose intolerance in a multi-ethnic population. Diabetes Care2003; 26: 290–296
24. Seifart U, Strempel I. The dry eye syndrome and diabetes mellitus.Ophthalmologe. 1994;91:235–239