



## TEAR PROFILE IN PATIENT WITH HYPERTENSION- A COMPARATIVE STUDY

### Ophthalmology

**Mr. Jaydevsinh Pargara\***

Phd Scholar, Gujarat University and Assistant Professor, Department of Optometry, BDIPS, CHARUSAT, Gujarat \*Corresponding Author

**Dr. Dipali Satani**

Ophthalmologist, Head- Department of Cornea and Refractive Surgery, Nagri Eye Hospital, Ahmedabad, Gujarat.

**Ms. Vrushti Vyas**

3rd Year B.Optomtry, Department of Optometry, BDIPS, CHARUSAT, Gujarat.

### ABSTRACT

The aim of the study was to compare the tear film quantity, quality and biochemistry in patient with hypertension with healthy controls. The subjects who is already diagnosed with the hypertension were included. All the procedure was followed by the tenets of the Declaration of Helsinki and informed consent was taken. An ocular surface disease index (OSDI) score were noted with the help of questionnaire and ocular examination were done for all the patient. A non-invasive break up time (NIBUT), Schirmer test, invasive break up time(TBUT), and tear fern pattern test were performed. OSDI score was significantly higher ( $p < 0.001$ ) in patient with hypertension compare to healthy controls. The value of NIBUT, TBUT, Schirmer test was significantly lower ( $p < 0.001$ ) in hypertension patient than healthy controls. The grading of tear fern pattern was significantly higher ( $p < 0.001$ ) hypertension patient. It was found that there is a need of on time ocular examination especially the anterior ocular structure when patient suffering from hypertension as they have inferior tear profile.

### KEYWORDS

Tear Film, Hypertension, Tear Fern, Invasive and Non-invasive Break Up Time, Ocular Surface Disease Index

### INTRODUCTION

The tear film is responsible for providing a smooth refractive surface for clear vision, maintaining the health of corneal and conjunctival epithelia, and acting as the first line of defense against microbial infections. Tear film composition is dynamic and in a constant state of flux, responding to environmental conditions in order to maintain ocular surface homeostasis. Traditionally, the tear film was described as being composed of three separate and distinct layers: mucin, aqueous, and lipid. However, new studies suggest that mixing between the mucin and aqueous layer occurs, creating a gradient of decreasing mucin concentration into the aqueous layer.<sup>[1]</sup> There are several functions of the tear film, including maintaining a smooth surface for refraction of light, lubrication of the ocular surface, supplying the avascular cornea with nutrients, removing foreign materials from the cornea and conjunctiva, and protecting the eye from pathogens.<sup>[2]</sup>

Patients with hypertension often exhibit alterations in their tear film profile, including increased tear film osmolarity and changes in cytokine levels. These changes can lead to symptoms of dry eye and ocular surface disease, highlighting the need for careful monitoring and management of ocular health in hypertensive individuals. Increased Tear Film Osmolarity: Hypertensive patients may experience elevated tear film osmolarity, which is a key indicator of dry eye disease. This increase can lead to discomfort and irritation. Altered Lipid Layer: The lipid layer of the tear film, which is crucial for preventing evaporation, may be compromised in hypertensive individuals. This can result in a less stable tear film and increased evaporation rates. Cytokine Imbalance: Hypertension can influence the levels of inflammatory cytokines in the tear film, contributing to ocular surface inflammation and exacerbating dry eye symptoms. Meibomian Gland Dysfunction: Hypertensive patients may also experience meibomian gland dysfunction, which affects the secretion of lipids necessary for a healthy tear film.<sup>[10,11]</sup> In hypertension the dry eye is influenced by systemic factors such as inadequate blood flow, which can impair the function of tear-producing glands, leading to decreased tear production and increased evaporation. Chronic inflammation associated with hypertension may also exacerbate dry eye symptoms, creating a complex interplay between these conditions.

### METHODS AND MATERIALS

It was cross sectional case control and comparative study done with patient suffering from hypertension. A total of 217 patients with an age group of 18 to 55 years comprises 110 patients of healthy controls and 107 patients with hypertension were included in the study. The study follow the tenets of the Declaration of Helsinki and informed consent was taken. It was approved by the institutional ethics committee-CHARUSAT. A patient with a history of ocular surgery, ocular trauma, corneal opacity, glaucoma, uveitis, history of contact lens use, Ocular surface disorder such as chemical and thermal injuries, Stevens-

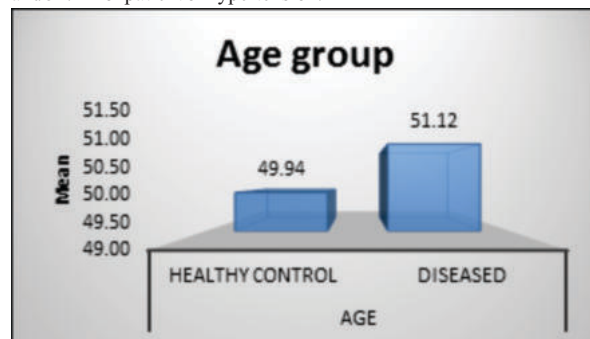
Johnson syndrome, MGD (Meibomian Gland Dysfunction), LGD (Lacrimal Gland Dysfunction), blink disorders, Smoking and alcohol consumption, Use of topical and/or systemic medications which may cause dry eye were excluded from the study. OSDI (Ocular surface disease index) score was taken with the questionnaire and assessed on scale of 0 to 100. Higher score represents the greater disability. The index provides sensitivity and specificity in distinguishing between normal subject and patient with dry eye disease. General eye checkup was performed for each subjects undergone study. NIBUT (Non-invasive break up time) was taken with the help of B+L manual kerotometer, schirmer test was performed to check the quantity of the tear film without use of topical anesthetic eye drops. TBUT (Tear break up time) was measure to observe the quality of the tear film thorough the slit lamp. The gross biochemical level of tear film can be estimated by the help of tear fern pattern. About about 5–20  $\mu$ l tear was collected through the glass pipette and immediately pipetted onto a glass microscope slide and allowed to dry for 7 to 10 minutes under the control room illumination and humidity.

### Statistical Analysis

The statistical analysis was carried out by using Statistical Package for Social Science software (SPSS Inc., Chicago, IL, USA) and Microsoft Office Excel 2007. The results were express as mean  $\pm$  standard deviation. An unpaired was performed based on the normality of the data, to assess the changes in the tear film quality, quantity and tear fern for two different groups. Multiple Comparison of all variables were done through the Bonferroni test. For OSDI score, the person correlation test was done to see the correlation between the OSDI score and different variables. The p value of less than 0.05 is considered significant.

### RESULT

The mean age group of included patient were 49.94 for healthy control and 51.12 for patient of hypertension.



Graph.1 – Age Group (Healthy Control Vs Hypertension Patient)

**Table.1 – Group Statistics**

| Overall statistics |                 | N   | Mean  | Std. Deviation | t test Unpaired | DF  | P Value |
|--------------------|-----------------|-----|-------|----------------|-----------------|-----|---------|
| Age                | Healthy Control | 110 | 49.94 | 4.48           | 18.96           | 217 | <0.001  |
|                    | Diseased        | 107 | 51.12 | 4.11           |                 |     |         |
| NIBUT              | Healthy Control | 110 | 16.45 | 2.33           | 25.66           | 217 | <0.001  |
|                    | Diseased        | 107 | 11.20 | 2.98           |                 |     |         |
| Schirmer           | Healthy Control | 110 | 18.90 | 2.65           | 23.17           | 217 | <0.001  |
|                    | Diseased        | 107 | 10.95 | 3.11           |                 |     |         |
| ITBUT(F)           | Healthy Control | 110 | 15.98 | 1.66           | 20.41           | 217 | <0.001  |
|                    | Diseased        | 107 | 10.30 | 1.97           |                 |     |         |
| Tear fern test     | Healthy Control | 110 | 1.22  | 0.49           | 18.02           | 217 | <0.001  |
|                    | Diseased        | 107 | 2.31  | 1.02           |                 |     |         |
| OSDI score         | Healthy Control | 110 | 4.99  | 1.01           | 19.88           | 217 | <0.001  |
|                    | Diseased        | 107 | 12.33 | 0.88           |                 |     |         |

The mean value of NIBUT for healthy control was  $16.45 \pm 2.33$  second compare to the mean value of hypertension patient with  $11.20 \pm 2.98$  second with p value of <0.001. The Schirmer test shows  $18.90 \pm 2.65$  mm in the healthy subjects compared to the reduced amount of  $10.95 \pm 3.11$  mm which shows significant difference ( $p < 0.001$ ). The quality of the tear film was assessed through the ITBUT(F) with a time duration of  $15.98 \pm 1.66$  second in healthy patient and  $10.30 \pm 1.97$  second in patient with hypertension ( $p < 0.001$ ).

The estimation of gross biochemical level for tear film through the tear fern test in patient with hypertension was compare with the  $1.22 \pm 0.49$  in healthy controls ( $p < 0.001$ ).

**Table.2- Correlation of OSDI with Other Parameters**

| Group No. |            |                     | OSDI SCORE | NITBUT | Schirmer | ITBUT(F) | Tear fern test |
|-----------|------------|---------------------|------------|--------|----------|----------|----------------|
| HTN       | OSDI SCORE | Pearson Correlation | 1          | 0.082  | 0.043    | -0.077   | 0.020          |
|           |            | Sig. (2-tailed)     |            | 0.405  | 0.665    | 0.438    | 0.842          |
|           |            | N                   | 217        | 217    | 217      | 217      | 217            |

As mentioned in the table.2 it has been found that the symptoms based patient reported OSDI scores were negatively correlated to the invasive tear break up time and positively correlated to the non-invasive tear break up time, Schirmer test and tear fern pattern.

## DISCUSSION

Assessment of tear film is a crucial part of ocular examination which enable the practitioner to final diagnosis of dry eye disease and its type. There are various tests to be done for derivation of term "Dry eye". Addition to the Schirmer test, TBUT and NIBUT, we have added the tern fern test and vision related symptoms based scoring of dry eye disease i.e OSDI (Ocular surface disease index). Zeeshan et al. found that the level of tear film in hypertensive patient was slightly diminished as compared to the normotensive group of patient where the mean Schirmer values was  $9.00 \pm 0.58$  mm in total of 100 patients [12]. In one of the study related to the dry eye rate in primary hypertensive patient it was found that The ratio of DE in hypertension patients was higher than in the control group (41.7% versus 18.8%;  $P < 0.001$ ). The proportion of patients with DE increased gradually according to the hypertension stage: 27.1% in stage I, 40.3% in stage II, and 57.6% in stage III,  $P < 0.001$ . [13] Our study shows the value of Schirmer value of  $18.90 \pm 2.65$  mm in the healthy subjects compared to the reduced amount of  $10.95 \pm 3.11$  mm which shows significant difference ( $p < 0.001$ ). OSDI score is determining the severity of dry eye in form of normal, mild, moderate and severe dry eye. Tran et al. reported that OSDI scores were significantly ( $p < 0.001$ ) higher in various stages of the hypertension patients as correlated to the grade of Schirmer which was comparative analysis and it was statistically significant between hypertensive and normotensive patient respectively. The gross idea of tear film biochemistry assessed by Tear fern pattern was not investigated in any of the previous study. In our study we have found that the value of tear fern grading which was an indication of gross biochemical status of tear was  $2.31 \pm 1.02$  in patient with hypertension compared to the  $1.22 \pm 0.49$  in healthy controls. Looking at the data found in this study, we can say that tear film assessment is an important in case of the patient suffering from hypertension irrespective of primary or secondary as few of the parameters like symptoms score of dry eye is positively correlated to the schirmer test, non-invasive tear break up time and tear fern pattern.

## CONCLUSION

Patient suffering from hypertension is having compromised tear

profile which may include tear quality and functions. OSDI score for hypertension patient suggestive of mild to moderate dry eye which is correlated to the symptoms hence required regular anterior ocular surface examination. Looking at the data of NIBUT, TBUT and schirmer test, it is concluded that patient with hypertension is suffering with mild to moderate dry eye. Tear fern pattern can act as bio marker to confirm the ocular surface disease in patient with hypertension.

## REFERENCES

- [1] Peters, E., & Colby, K. (2006). The tear film. Foundation Volume 2: Physiology of the Eye and Visual System.
- [2] Sweeney, D. F., Millar, T. J., & Raju, S. R. (2013). Tear film stability: a review. *Experimental eye research*, 117, 28-38.
- [3] Tiffany, J. (2008). The normal tear film. *Developments in ophthalmology*, 41(R), 1.
- [4] Holly, F. J. (1980). Tear film physiology. *Optometry and Vision Science*, 57(4), 252-257.
- [5] Holly FJ, Lemp MA: Tear physiology and dry eyes: review. *Surv Ophthalmol* 22:69, 1997.
- [6] Masmali, A. M., Purslow, C., & Murphy, P. J. (2014). The tear ferning test: a simple clinical technique to evaluate the ocular tear film. *Clinical and Experimental Optometry*, 97(5), 399-406.
- [7] Hagan, S., Martin, E., & Enriquez-de-Salamanca, A. (2016). Tear fluid biomarkers in ocular and systemic disease: potential use for predictive, preventive and personalised medicine. *Epm Journal*, 7, 1-20.
- [8] Fong, P. Y., Shih, K. C., Lam, P. Y., Chan, T. C. Y., Jhanji, V., & Tong, L. (2019). Role of tear film biomarkers in the diagnosis and management of dry eye disease. *Taiwan journal of ophthalmology*, 9(3), 150-159.
- [9] Foulks, G. N., & Pflugfelder, S. C. (2014). New testing options for diagnosing and grading dry eye disease. *American journal of ophthalmology*, 157(6), 1122-1129.
- [10] Mravec Bencurova D, Vyborny P, Dankova P. Comparative analysis of tear cytokines in patients with glaucoma, ocular hypertension, and healthy controls. *International Ophthalmology*. 2023 Oct;43(10):3559-68.
- [11] Labbé A, Terry O, Brasnu E, Van Went C, Baudouin C. Tear film osmolarity in patients treated for glaucoma or ocular hypertension. *Cornea*. 2012 Sep 1;31(9):994-9.
- [12] Yu, K., Bunya, V., Maguire, M., Asbell, P., Ying, G. S., Assessment, D. E., & Management Study Research Group. (2021). Systemic conditions associated with severity of dry eye signs and symptoms in the dry eye assessment and management study. *Ophthalmology*, 128(10), 1384-1392.
- [13] Kamil, Z. (2020). Hypertension and dry eye. *Journal of Surgery Pakistan*, 25(3), 127-30.
- [14] Thang, T. T., Phuong, P. H., Huynh, N. S., Kien, N. T., Toan, N. D., Ha, N. T. T., ... & Thang, L. V. (2024). Dry eye rate and its relationship with disease stage in patients with primary hypertension: a cross-sectional study in Vietnam. *International Journal of Ophthalmology*, 17(4), 653.
- [15] Al Houssien, A. O., Al Houssien, R. O., & Al-Hawass, A. (2017). Magnitude of diabetes and hypertension among patients with dry eye syndrome at a tertiary hospital of Riyadh, Saudi Arabia—A case series. *Saudi Journal of Ophthalmology*, 31(2), 91-94.
- [16] Kalkan Akcay, E., Akcay, M., Can, G. D., Aslan, N., Uysal, B. S., Ceran, B. B., ... & Cagil, N. (2015). The effect of antihypertensive therapy on dry eye disease. *Cutaneous and Ocular Toxicology*, 34(2), 117-123.
- [17] Guarnieri, A., Carnero, E., Bleau, A. M., Alfonso-Bartolozzi, B., & Moreno-Montañés, J. (2020). Relationship between OSDI questionnaire and ocular surface changes in glaucomatous patients. *International Ophthalmology*, 40(3), 741-751.
- [18] Katz, G., Springs, C. L., Craven, E. R., & Montecchi-Palmer, M. (2010). Ocular surface disease in patients with glaucoma or ocular hypertension treated with either BAK-preserved latanoprost or BAK-free travoprost. *Clinical Ophthalmology*, 1253-1261.
- [19] Stewart, W. C., Stewart, J. A., & Nelson, L. A. (2011). Ocular surface disease in patients with ocular hypertension and glaucoma. *Current eye research*, 36(5), 391-398.