

COMPARATIVE STUDY OF DRY EYE SYNDROME AT HIGH ALTITUDE AND LOW ALTITUDE REGIONS

AUTHORS:

Basharat Hussain¹

Rashida Riaz²

Ammara Rasheed³

For Authors' affiliation & contribution
see end of Article

ABSTRACT

PURPOSE: To study and compare the dry eye syndrome at high altitude (Khaplu Gilgit Baltistan) and low altitude (Lahore Punjab) regions.

METHOD: A cross sectional study has been taken in two groups. The data of group A is taken at height of 2600m (Khaplu Gilgit Baltistan) and the data of group B is taken at low altitude (Lahore Punjab) and compared the dry eye syndrome at high and low altitude regions. One group contains 44 subjects at high altitude and second group also contain 44 subjects at low altitude. In order to collect data the OSDI questionnaire system is used which is a more reliable, authentic tool to find prevalence of dry eye. Scoring system is used to find out end result.

RESULTS: 88 subjects were enrolled in this study. Out of which half of the data i.e. 44 is collected at high altitude region (Khaplu district in Gilgit Baltistan) and the remaining half is taken from low altitude region i.e. from Lahore Punjab. At high altitude region total 44 subjects were enrolled out of which 18 (40.9%) subjects were normal, 9 (20.4%) subjects with mild dry eye syndrome, 12 subjects (27.2%) with moderate DES and 5 subjects (11.3%) with severe DES. Similarly, at low altitude (Lahore Pakistan) total 44 subjects were enrolled out of which 30 (68.1%) subjects were normal, 7 (15.9%) subjects with mild dry eye syndrome, 4 subjects (9.0%) with moderate dry eye syndrome and only 3 (6.8%) subjects with severe dry eye syndrome. The incidence of dry eye was found significantly high at high altitude region as compared to low altitude region (Chi-square test, $p=0.04$). P -value < 0.05 , that shows the significant result, so that there is significant difference of DES at high altitude and low altitude regions. There is more risk of occurrence of DES at High altitude.

CONCLUSION: The prevalence of DES at high altitude is significantly higher as compared to low altitude region ($p=0.04$). Many environmental factors which play role in increasing the incidence of dry eye at high altitude such as high exposure to UV radiation due to height, dry environment, low temperature, low humidity, and wind chill factor.

KEY WORDS: Ocular surface disease index, Khaplu, dry eye syndrome, dry eye

INTRODUCTION

The dry eye syndrome is defined as the tear film abnormality due to tear deficit / extreme evaporation, which harm to ocular surface and is related with symptoms of distress. Keratoconjunctivitis sicca means dryness of cornea and conjunctiva.² The dry eye syndrome in which eye do not produce enough tear is called Sjogren syndrome³. One of the most common autoimmune disorders is Sjogren's syndrome.⁴ Early clinical signs of Sjogren syndrome are mainly decreased secretion of tear and saliva leading to dry eye syndrome.⁵ The symptoms of dry eye include stingy, burning, scratchy and feeling of an external material in the eyes, gristly mucus in or

round the eyes, irritation of the eyes from smoke or breeze, exhaustion of the eyes after short periods of reading, uneasiness during reading, watching TV, or working on the phone and blurring of vision that recovers after blinking of eyes. Quality of life is absolutely affected in Patients with dry eye symptoms.⁷ Dry eye (DE) is a common disorder that affects millions of individuals around the world. Depending on the criteria used for diagnosis, the prevalence of this disease differs. Lacrimal Function Unit (LFU)⁶ is a multifactorial disease test characterized by ocular discomfort and pain, visual disturbance, instability of the tear film, increased tear osmolality, and inflammation.⁹ Depending on the

environmental conditions to which patients are exposed in their daily lives, symptoms and signs can vary greatly.

High altitude means elevations that are at minimum of 2600 meters above sea level and cause several environmental and physiological changes.¹⁰ High altitude is correlated with functional and some pathological changes associated with adverse environmental conditions including low atmospheric pressure, low oxygen pressure, little moisture,¹¹ high UV radiation,¹² and reduce temperature with wind chilly factors.¹³ Increased tear evaporation due to low humidity, result in increased tear film osmolarity¹⁴ which cause dry eye disease.¹⁵ This study has been carried out at low and high altitude. DES (dry eye syndrome) is common at height. A population based study recorded 52.4 percent dry eye syndrome¹⁷ prevalence in Tibet.

This study will evaluate the occurrence of DE syndrome at high altitude and to relate its occurrence at a low altitude region (Lahore Punjab) by help of dry eye symptoms based questionnaire and to study the effects of altitude on human eye at height of 2600 meters above sea level. High altitude exposure leads to an altered tear film resulting in an increased TFO (Tear film osmolality) and a reduced TBUT (tear film breakup time).¹⁸

The high-altitude region in this study is Khaplu District which is the last district of Gilgit Baltistan at the height of 2601m above sea level. It is situated in north of Pakistan with population of 175000. There is a need to modify living conditions to prevent the harmful effects of dry eye syndrome. It will be possible to use lubricants and eye shades.

MATERIALS AND METHODS

88 subjects were enrolled in this study. The data of group A is taken at height of 2600m (Khaplu Gilgit Baltistan region), the data of group B is taken at low altitude (Lahore Punjab) and compare the dry eye syndrome at high and low altitude regions. An

authentic and reliable worldwide using, OSDI questionnaire system is used. Scoring system is also used to find out the overall prevalence of dry eye based on its symptoms. Subjects were asked about the duration of symptoms persistence. The range of OSDI is in between of 0-100 scoring points. The score represents the severity of DE. The score decides the normal subjects and DE patients. The overall OSDI score differentiate the normal, moderate, mild and severe dry eye syndrome subjects. The subjects are normal having points between (0-10), subjects having mild DES (11- 21) points, moderate DES having (22-30) points and severe DES having (31-100) points. OSDI ocular symptoms disease index which is valid and trustworthy tool for finding the severity of DE. The Ocular Surface Disease Index (OSDI) is the most widely used study tool for dry eye research to find the severity of eyes surface disorders.

The total score (points) are find by this worldwide using OSDI (ocular surface disease index) formula:

$$\text{OSDI} = \frac{1}{4} * [(\text{addition of score of total questions answered}) / (\text{all number of question answered})] * 100.$$

RESULTS

After comparing data from both group the incidence of dry eye is significantly high at high altitude then at low altitude. According to (table 1) there at low altitude there are 30 normal subjects, 7 with mild DES, 4 with moderate DES and 3 with severe DES and at high altitude only 18 subjects were normal, 9 with mild DES, 12 with moderate DES and 5 with severe DES. This data is also mentioned in detail using a graph (graph 1).

The subjects will be normal if having points between (0-10), having mild DES (11- 21) points, having moderate DES having (22-30) points and having severe DES (31-100) points.(Chi-square test, $p=0.04$) P -value < 0.05, that shows the significant result, so that there is significant difference of DES at high altitude and low altitude regions. There is more risk of occurrence DES at High altitude.

DISCUSSION

This research is done to find out the occurrence of DES at high altitude and comparison it with people at low altitude. There is high occurrence of dry eye syndrome at height (Gilgit Baltistan district Khaplu) as compared to low altitude region (Lahore Pakistan). Khaplu is less populated area in northern region of Pakistan, which is situated at the height of 2000-3000 meters above sea level. The main purpose is to comparing and study the dry eye syndrome in Khaplu, region (2601m high then sea level) and Lahore Punjab (plain region).

Dry eye syndrome is a common eye abnormality causing stressful symptoms to the patients. It is mostly ignored in clinical settings, although it effects the quality of life. Dry eye syndrome is associated with ocular symptoms such as stinging, red eyes, itching, ocular tiredness and optical disturbance.

The main purpose of this research is to create the diagnose of dry eye, to discriminate it from other eye complications which cause redness, irritation, to find the causes of dry eye, to create suitable therapy, to release distress, and to avoid from other eye complications such as Corneal punctate staining, filamentary keratitis, corneal degradation, keratinization of the eyes, ulcer of cornea, thinning of cornea, and sterile melting of the cornea with potential puncture and instruct the patients and implicate them in handling these syndromes. Dry eye syndrome can be treated by improving the factors which causing dry eye such as environmental factors and ocular distress. Environmental improvement is necessary for those people who are living in dusty conditions and low humidity areas which cause evaporation of tear from ocular surface. Increasing of dampness in this environment is obligatory to avoid dry eye syndrome.

Prevention could be done by use of lubricants, supplementation and by dispersion mucin at high altitude regions. The use of standard glasses raises the moisture around the cornea by 15 percent and

this can be increased to 50 percent if use glasses with side shields.

In case of severe DES a patient can use a special type of bandage contact lens having higher content of water and it is helpful in healing of epithelial surface. It also minimizes friction between eyelids and surface of eye. This research revealed higher occurrence of dry at height than at low altitude. After getting result of high prevalence of DE at high altitude in khaplu district in Gilgit Baltistan the most important thing is to educate the natives living there about the chronic essence of disease and give precise instruction for therapeutic regimen.

CL intolerance and related complications are common in patients with extreme dry eye syndrome. The greater occurrence of dry eye syndrome is big issue at high altitude and knowledge of its public occurrence is important for suitable identification, timely reference to an eye doctors when possible, and adequate DE monitoring in Khaplu District of Gilgit Baltistan region is necessary.

CONCLUSION

According to this study the incidence of Dry eye syndrome is significantly ($p=0.04$) high at high altitude region (Khaplu Gilgit Baltistan) as compared to low altitude region (Lahore Punjab). The result show high number of subjects suffering from mild, moderate, and severe dry eye syndrome. The incidence of DE (dry eye) is comparatively more at high altitude. All doctors are must be made aware of the symptoms in order to identify them immediately and treat them quickly. Patients suffering from severe Dry eye syndrome are at higher risk. So the eye care practioner need to give awareness about environmental changes occurring and treat them properly to minimize the loss of vision as well as to take care of ocular health.

Table 1: Comparison of severity of dryness at high and low altitude

| | | Dryness | | | | P-value |
|--------|----------------------|---------|------|----------|--------|---------|
| | | Normal | Mild | Moderate | Severe | |
| Groups | High altitude (n=44) | 18 | 9 | 12 | 5 | 0.04 |
| | Low altitude (n= 44) | 30 | 7 | 4 | 3 | |
| Total | | 48 | 16 | 16 | 8 | |

REFERENCES

- Javadi MA, Feizi S. Dry eye syndrome. *J Ophthalmic Vis Res.* 2011;6(3):192-8.
- Bhavsar AS, Bhavsar SG, Jain SM. A review on recent advances in dry eye: Pathogenesis and management. *Oman J Ophthalmol.* 2011;4(2):50-6.
- Akpek EK, Bunya VY, Saldanha IJ. Sjogren's Syndrome: More Than Just Dry Eye. *Cornea.* 2019;38(5):658-61.
- Nguyen CQ, Peck AB. Unraveling the pathophysiology of Sjogren syndrome-associated dry eye disease. *Ocul Surf.* 2009;7(1):11-27.
- Labetoulle M, Bourcier T, Doan S, Group D. Classifying signs and symptoms of dry eye disease according to underlying mechanism via the Delphi method: the DIDACTIC study. *Br J Ophthalmol.* 2019;103(10):1475-80.
- Rios JL, Boechat JL, Gioda A, Dos Santos CY, De Aquino Neto FR, Lapa E Silva JR. Symptoms prevalence among office workers of a sealed versus a non-sealed building: associations to indoor air quality. *Environ Int.* 2009;35(8):1136-41.
- Kuo YK, Lin IC, Chien LN, Lin TY, How YT, Chen KH, et al. Dry Eye Disease: A Review of Epidemiology in Taiwan, and its Clinical Treatment and Merits. *J Clin Med.* 2019;8(8):1227.
- Abusharha AA, Pearce EI. The effect of low humidity on the human tear film. *Cornea.* 2013;32(4):429-34.
- Ishioka M, Shimmura S, Yagi Y, Tsubota K. Pterygium and dry eye. *Acta Ophthalmol.* 2001;215(3):209-11.
- Galor A, Kumar N, Feuer W, Lee DJ. Environmental factors affect the risk of dry eye syndrome in a United States veteran population. *J Ophthalmol.* 2014;121(4):972-3.
- Stahl U, Willcox M, Stapleton F. Osmolality and tear film dynamics. *Clin Exp Optom.* 2012;95(1):3-11.
- Alves M, Novaes P, Morraye MDA, Reinach PS, Rocha EM. Is dry eye an environmental disease? *Arq bras oftalmol.* 2014:193-200.
- Alves M, Novaes P, Morraye MDA, Reinach PS, Rocha EM. Is dry eye an environmental disease? *Arquivos brasileiros de oftalmologia.* 2014;77(3):193-200.
- Willmann G, Schatz A, Fischer MD, Schommer K, Zrenner E, Bartz-Schmidt KU, et al. Exposure to high altitude alters tear film osmolarity and breakup time. *High Alt Med Biol.* 2014;15(2):203-7.