Tear Break-up Time in High Altitude Areas

Col KN Jha (Retd)*

Abstract

Background: In high altitude areas, patients report with irritation, redness and foreign body sensation in their eyes suggesting tear film abnormality due to low humidity and windy environmental conditions .

Methods: Tear Break- up Time (TBUT) was studied in 100 subjects consisting of local population and those originally from plains residing in high altitude areas in Ladakh.

Result: There were 24 % individuals with TBUT of < 5 seconds, 30 % between 6-10 seconds and 46 % with TBUT of > 10 seconds. In symptomatic patients with TBUT of <5 seconds, eight cases had irritation of eyes, six foreign body sensation and two cases had pain, watering, irritation and redness of eyes. Pterygium was seen in 12 individuals and inter palpebral congestion in 4 cases.

Conclusion: A total of 24 % cases showed abnormal (<5 seconds) TBUT. Abnormality of tear film in the presence of low humidity and windy condition with high ultraviolet radiation may lead to ocular discomfort and pterygium in these areas.

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Key Words: Tear Break-up Time (TBUT); High altitude areas (HAA)

Introduction

Excessive exposure to outdoor conditions and ultraviolet (UV) radiation is associated with degenerative conjunctival changes [1]. Lower humidity also results in increased tear film evaporation [2]. Evidence suggests that dry eye symptoms are exacerbated due to low humidity, windy situations and close work [3]. Therefore prevalence of dry eye syndrome (DES) in Ladakh may be due to environmental factors e.g. high altitude and dryness which accelerate tear loss [4]. Upto 5% of people from high altitude areas (HAA) in Ladakh complain of irritation, redness and foreign body sensation in their eyes [5]. The failure of tear film function results in foreign body sensation, fatigue and dryness [6].

We studied Tear Break-up Time (TBUT) in persons reporting with ocular irritation, redness and foreign body sensation of at least one-month duration and compared the same with the TBUT in asymptomatic individuals.

Material and Method

A total of 100 subjects of both sexes were studied, which included the local population and those originally from the plains but staying in high altitude area in Ladakh. The subjects included asymptomatic individuals, patients with symptoms of ocular irritation, foreign body sensation and redness of the eyes, for at least one month duration. The study excluded people with history of conjunctivitis, corneal disease, uveitis, glaucoma, ocular/systemic allergy or atopy. Patients on topical medications, systemic beta-adrenergic blocker, diagnosed dry eye disease, collagen diseases, thyroid eye

disease, history of eye surgery during previous two months and an any eye with persistent tear break up pattern suggestive of epithelial disease were excluded.

TBUT is the time taken between a complete blink and appearance of the first randomly distributed corneal dry spot, seen with the aid of fluorescein applied to the eye [7]. A fluorescein strip was moistened with balanced salt solution (BSS) and the inferior tarsal conjunctiva was touched lightly with this strip. The patient was asked to blink several times to distribute the dye in the tear film. The patient was then asked to stare without blinking while the cornea was observed through biomicroscope using broad tangential illumination with cobalt blue filter. The time between a complete blink and appearance of first defect as a random dark spot in the fluorescein film was measured in seconds. No anaesthetic was used as it could hasten the tear breakup. Ten seconds or more was considered a normal value. At least three readings were taken for both the eyes separately. An average of three readings was taken as result. The SPSS version 9.0 was used for statistical analysis. Chi-square test was employed to study the association between the TBUT and the study parameters. A p value of <0.005 was taken as significant.

Results

Of the 100 subjects, 60 were aged below 40 years (range 21– 62 years) and majority (84) were males. Study population comprised 60 of those originally from plains residing in high altitude areas (serving soldiers) and 40 local residents of Ladakh. 52 of the former group were staying in the HAA for more than six months. Average TBUT among males was 11.93 seconds and 9.18 seconds for females, which was statistically significant (p value = 0.000). However no significant association between TBUT and age, place of residence (high

*Professor of Ophthalmology, Manipal College of Medical Sciences, P.O.Box No.341, Pokhara, Nepal.

Table 1
Details of study group and Tear Break-up Time (TBUT)

Parameters		Number	Average TBUT	p value
Sex	Male	84	11.93	0.000 *
	Females	16	9.18	
Age in years	Up to 40	60	11.00	0.988
	Above 40	40	12.23	
Altitude	Low Landers	60	13.53	0.006
	High Landers	40	8.53	
Symptoms	Symptomatic	54	11.40	0.998
	Asymptomatic	46	11.87	

* significant association

altitude resident or lowlander), symptomatic and asymptomatic individuals was noticed (Table.1).

There were 24 individuals with TBUT of < 5 seconds, 30 with TBUT between 6-10 seconds and 46 with TBUT > 10 seconds. Amongst patients with TBUT of < 5 seconds, eight were asymptomatic. Amongst the symptomatic cases, irritation of the eyes was the commonest (8 cases) complaint. Six had foreign body sensation, while two cases reported pain, watering, and redness of eyes. Pterygium was seen in 12 cases and inter palpebral congestion in four cases. In the group with TBUT between 6-10 seconds, three had watering of eyes, two cases had both redness and watering and one individual had a pterygium. In the TBUT > 10 seconds group, 24 cases reported discomfort in the eyes. Of these seven had clinical findings in the form of eye congestion (2), bilateral pterygium (2) and inter palpebral congestion (3).

Discussion

A common test of tear film abnormality is TBUT, described by Norn and revised by Lemp and Holly [8]. Theoretically, TBUT shorter than blink interval of 5 seconds could result in surface damage and very short TBUT (< 2 seconds) indicates keratoconjunctivitis sicca (KCS). Tear film instability may result from either tear deficiency or evaporative dry eye syndrome (DES) resulting from meibomian gland dysfunction (MGD). In addition environmental factors such as humidity, temperature and wind may destabilize tear film and TBUT. An increased rate of evaporation can increase tear film osmolarity and create dry eye disease independent of aqueous tear deficiency [7]. In this study, 24 % of the study population had TBUT of < 5 seconds. If we consider these cases as having DES, then the prevalence of dry eye in this small study population is higher than 14.4% reported earlier [9]. However if patients with TBUT upto 10 seconds is considered as normal then a high 52 % cases will be considered as having compromised TBUT. About 22 % of cases with TBUT of > 10 seconds were symptomatic. These symptoms were probably due to environmental conditions of low humidity and dust-laden atmosphere with high wind speed in HAA. There is lack of

correlation between symptoms and signs in cases of DES [10]. Eight individuals with TBUT of <5 seconds were asymptomatic since TBUT of 2-5 seconds is considered as moderately unstable tear film. Additionally individual sensitivity to discomfort also varies.

Aqueous tear deficiency coupled with effects of high UV radiation leads to ophthalmoheliosis and ocular discomfort. Corneal drying and epithelial irregularity resulting in dellen formation may also contribute to formation of pterygium. We found a high prevalence of pterygium, with majority (12 cases) in TBUT of < 5 seconds group. Among 15 pterygium cases, local inhabitants accounted for 12 cases.

The ocular health care for troops emphasizes on UV protection in snow bound area. The possibility of abnormal tear film, as a cause of ocular discomfort in HAA has not been investigated. The current study on a limited population using TBUT as the single parameter for tear film stability has limitations. A prospective study on tear film stability may be conducted to evolve a strategy for ocular protection among the troops in HAA.

Conflicts of Interest

None identified

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