Original research

Dry eye signs and symptoms in night-time workers

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Abstract

Purpose: To determine the effect of night-time working on dry eye signs and symptoms.

Methods: A total of 50 healthy subjects completed a dry eye questionnaire and underwent clinical examinations including basic Schirmer's test and tear breakup time (TBUT) test on two consecutive days, before and after the night shift (12-hrs night-shift).

Results: All dry eye symptoms were aggravated significantly after the night shift ($P < 0.05$). Conjunctival redness increased after the night shift ($P = 0.001$). TBUT reduced significantly after the night-shift (8.06 vs 10.98 s) ($P = 0.001$). Basic Schirmer's test increased after the night-shift compared to its values before the shift (19.04 vs 17.34 mm) ($P = 0.037$).

Conclusion: Our study showed that night-time working can cause tear film instability and exacerbation of dry eye symptoms.

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Keywords: Dry eye; Basic Schirmer's test; TBUT test

Introduction

Dry eye is a common ocular disease that is associated with discomfort and irritation of the eyes and visual impairment. This is a disorder that causes inflammation of the ocular surface, tear film instability, increased osmolarity and worsens dry eye by creating a vicious cycle.[1] Dry eye can also cause loss of visual quality, constant irritation of the eyes, discomfort, a chronic pain, mood disorders, sleep disturbances, and loss of quality of life.[2] It also can reduce individual job performance.[3]

Circadian rhythms include physiological and behavioral changes such as changes in body temperature, blood pressure, blood cortisol level, melatonin level, level of consciousness, and many other items.[4] Adjustment of the body's internal clock is related to environmental brightness changes that regulates physiology of the peripheral organs through neuronal and hormonal signals.[5] Moreover, sleep deprivation is associated with autonomic and endocrine system changes such as increased blood pressure and decreased parasympathetic tone and increased secretion of stress hormones like norepinephrine and cortisol.[6] As tear secretion is under neuronal and hormonal controls, sleep deprivation can potentially impair tear film quality or quantity.

An important concern is about night-time workers. Regardless of their waking hours at night, their circadian rhythms are impaired because they are subject to light signals at work. The aim of this study was to evaluate dry eye symptoms and tear film indices changes in night-time workers.

Methods

The present study is a cross-sectional study. The study population included night-shift hospital staff (including medical and security staff). We excluded subjects with a history of ocular surface disease such as problems with the eyelids, conjunctiva and lacrimal system diseases, eye surgery in the last 6 months, systemic diseases associated with dry eye such as rheumatoid arthritis, lupus and Sjogren's syndrome, recent use of eye drops and contact lenses in the past 72 hrs, known history of any digestive disorder or diseases associated with vitamin A deficiency.

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All participants were examined on two consecutive days (before and after the night shift) at the same time (7 a.m.). Examination included a two-part assessment:

1 — Completing the questionnaire: First, for each of the subjects, we completed a questionnaire including the intensity of dry eye symptoms to calculate the severity score before and after the night-shift. Standard patient evaluation of eye dryness (SPEED) questionnaire[7] was used in this study. Four dry eye symptoms including dryness, grittiness or scratchiness, eye fatigue, soreness or irritation, and burning or watering were rated subjectively on a continuous scale from 0 to 4, which higher values reflected a higher severity of the symptoms. We calculated the severity score by adding the four values together. The questionnaire was completed before any eye manipulation.

2 — Clinical examination (on the left eye for all subjects) in the following order: ocular surface examination, determine the severity of conjunctival hyperemia, tear breakup time (TBUT) test, and basic Schirmer's test.

Conjunctival hyperemia was assessed using diffuse illumination technique, and the severity of bulbar hyperemia was recorded in comparison with standard images before and after the night-shift. We determined the severity of conjunctival hyperemia on a scale of 0—4 based on the comparison with standard images. For this purpose, the standard images of International Centre for Eye Care Education (ICEE) was used.[8]

After tarsal conjunctiva surface wetting with a fluorescein strip soaked in saline, tear film was evaluated by a blue filter. The time interval between the last blink and the appearance of the first dry spot on the surface of the cornea were determined as TBUT.

After applying anesthesia (tetracaine 0.5% drop) and removing remaining liquid in the lower fornix, Schirmer's strip (*Schirmer-plus, Gecis, Czech Republic*) was placed between the outer and middle third of the lower eyelid. After 5 min, the wet paper length was measured in mm. Location, time, and light condition was the same for each patient for Schirmer's tests.

All measurements in this study were non-invasive, and the provisions of the Declaration of Helsinki have been observed in the study. Informed consent was obtained from all participants and the study protocol was approved by the ethics committee.

All the data collected and coded in the computer and analyzed by SPSS 11 software. The Kendall rank test was used to compare dry eye symptoms before and after the night-shift. The Wilcoxon rank test was used to compare tear film parameters (TBUT and Schirmer's test) before and after the night-shift. We assessed the correlation between severity score changes and clinical parameters changes (TBUT and basic Schirmer's test) before and after the night-shift using non-parametric spearman's rank correlation coefficient test. The level of P-value < 0.05 was considered significant.

Results

In this study, 50 consecutive healthy subjects, including 31 males and 19 females with an age range between 24 and 50 years with a mean age of 33.34 (SD $\pm$ 6.5) years were assessed.

Dry eye symptoms questionnaire

The severity of dry eye symptoms were compared before and after the night-shift. Results showed that the severity of all the four dry eye symptoms were significantly higher after the night-shift ($P < 0.05$) (Tables 1—4).

Bulbar hyperemia

We showed that the conjunctival hyperemia was more severe after the night-shift ($P = 0.001$) (Table 2).

Tear film stability

Mean value of TBUT test after the night-shift was lower (lower tear film stability) than the mean value before the night-shift (8.06 $\pm$ 4.83 vs 10.98 $\pm$ 6.24 s) (Table 3). Analytical assessment showed that the difference before and after the night-shift is statistically significant ($P = 0.001$).

Basic Schirmer's test

Basic Schirmer's test values were measured before and after the night-shift (its minimum value was 2 mm and maximum value was 30 mm). The mean value of the test after the night-shift was greater than the mean value before the night-shift (19.04 $\pm$ 7.83 vs 17.34 $\pm$ 6.45 mm) (Table 3). Analytical assessment showed that the difference before and after the night-shift is statistically significant ($P = 0.037$). However, 7 subjects (14%) had a Schirmer's test value of less than or equal to 10 mm before the shift, while 10 subjects (20%) had a Schirmer's test value of less than or equal to 10 mm after the night-shift.

We assessed the correlation between total severity score changes and clinical parameters changes (TBUT, basic Schirmer's) before and after the night-shift. The correlation coefficient for the Schirmer's test was 0.078 ($P = 0.588$). The correlation coefficient for the TBUT test was -0.064 ($P = 0.657$). Results showed no correlation between total severity score changes and clinical parameters changes ($P > 0.05$) (Table 4).

Discussion

Sleep disturbance has a strong association with many disease that can potentially cause significant comorbidity and in some severe cases can cause morbidity on a patient.[9] Dry eye is a multifactorial disease involving the tear film and ocular surface.[10] Sympathetic and parasympathetic nerves stimulate tear production from lacrimal glands.[11] Sleep deprivation is associated with autonomic and endocrine system changes such as increased blood pressure and decreased parasympathetic tone and increased secretion of stress hormones like norepinephrine and cortisol. So sleep deprivation can potentially