RISK FACTORS FOR DRY EYE SYNDROME AMONG MILITARY PERSONNEL IN ARID CLIMATE CONDITIONS

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Abstract

Dry eye syndrome (DES) is one of the most common ocular surface disorders, especially among individuals exposed to prolonged unfavorable environmental conditions. The aim of this study was to identify the major risk factors for dry eye syndrome among military personnel serving in arid climate conditions. A total of 1000 military personnel stationed at military bases located in hot and dry regions were examined. The Ocular Surface Disease Index (OSDI©), Schirmer test, and tear breakup time (TBUT) were used to evaluate ocular surface condition and symptoms. The prevalence of DES was found to be 28.5%. The most significant risk factors included prolonged digital screen exposure for more than 8 hours per day, exposure to dust and wind, insufficient sleep duration, and seasonal allergies. Patients with DES demonstrated significantly lower TBUT and Schirmer test values compared to the control group ($p<0.001$). The obtained results confirm the significant influence of arid climate and occupational factors on the development of dry eye syndrome among military personnel.

Keywords: dry eye syndrome, military personnel, arid climate, OSDI, TBUT, Schirmer test, risk factors.

Аннотация

Синдром сухого глаза (ССГ) является одной из наиболее распространённых патологий поверхности глаза, особенно среди лиц, подвергающихся длительному воздействию неблагоприятных факторов окружающей среды. Цель исследования — определить основные факторы риска развития синдрома сухого глаза у военнослужащих, проходящих службу в условиях аридного климата. Проведено обследование 1000 военнослужащих, дислоцированных на военных базах с жарким и сухим климатом. Для оценки симптомов использовали опросник OSDI©, а также тест Ширмера и время разрыва слёзной плёнки (TBUT). Установлено, что распространённость ССГ составила 28,5%. Наиболее значимыми факторами риска оказались длительная работа с цифровыми устройствами более 8 часов в сутки, воздействие пыли и ветра, недостаточная продолжительность сна и сезонная аллергия. У лиц с ССГ показатели TBUT и теста Ширмера были достоверно ниже по сравнению с контрольной группой ($p <0,001$). Полученные данные подтверждают значительное влияние аридного климата и профессиональных факторов на развитие синдрома сухого глаза у военнослужащих.

Ключевые слова: синдром сухого глаза, военнослужащие, аридный климат, OSDI, TBUT, тест Ширмера, факторы риска.

Annotatsiya

Quruq ko‘z sindromi (QKS) ko‘z yuzasi kasalliklari orasida eng keng tarqalgan patologiyalardan biri bo‘lib, ayniqsa noqulay ekologik omillar ta’sirida uzoq muddat faoliyat yurituvchi shaxslarda ko‘proq uchraydi. Tadqiqot maqsadi — arid iqlim sharoitida xizmat qilayotgan harbiy xizmatchilarda quruq ko‘z sindromining asosiy xavf omillarini aniqlashdan iborat. Issiq va quruq iqlimga ega harbiy bazalarda xizmat qilayotgan 1000 nafar harbiy xizmatchi tekshirildi. Simptomlarni baholash uchun OSDI© so‘rovnomasi, Shirmer testi va ko‘z yoshi pardasining uzilish vaqti (TBUT) qo‘llanildi. Tadqiqot natijasida QKS tarqalishi 28,5% ni tashkil qilgani aniqlandi. Eng muhim xavf omillari sifatida kuniga 8 soatdan ortiq raqamli qurilmalardan foydalanish, chang va shamol ta’siri, uyqu yetishmasligi hamda mavsumiy allergiyalar qayd etildi. QKS aniqlangan bemorlarda TBUT va Shirmer testi ko‘rsatkichlari nazorat guruhiga nisbatan ishonchli darajada past bo‘ldi ($p<0,001$). Olingan natijalar arid iqlim va kasbiy omillarning harbiy xizmatchilarda quruq ko‘z sindromi rivojlanishiga sezilarli ta’sir ko‘rsatishini tasdiqlaydi.

Kalit so‘zlar: quruq ko‘z sindromi, harbiy xizmatchilar, arid iqlim, OSDI, TBUT, Shirmer testi, xavf omillari.

Introduction

Dry eye syndrome (DES) is a multifactorial disorder of the ocular surface characterized by instability of the tear film, ocular discomfort, inflammation, and visual disturbances [1]. In recent years, the prevalence of DES has increased significantly due to environmental pollution, prolonged digital device use, and adverse climatic conditions [2].

Military personnel represent a high-risk group for the development of DES because military service combines several occupational and environmental risk factors. Personnel deployed in arid and desert climates are continuously exposed to high temperatures, low humidity, wind, dust particles, and airborne pollutants, all of which accelerate tear film evaporation and disrupt ocular surface homeostasis [3].

In addition, modern military activities increasingly require prolonged work with digital screens, surveillance systems, and communication devices. Extended screen exposure reduces blink frequency and contributes to evaporative dry eye disease [4]. Sleep deprivation, irregular duty schedules, and physical stress may further aggravate tear film dysfunction and ocular discomfort [5].

Several studies have demonstrated that environmental pollution, low humidity, thermal exposure, and prolonged visual display terminal use are strongly associated with dry eye symptoms and tear film instability [6,7]. Despite the operational importance of visual performance in military settings, dry eye syndrome among military personnel remains underdiagnosed and often treated symptomatically.

Therefore, assessment of the prevalence and major risk factors of DES in military personnel serving in arid climate conditions is important for improving occupational health and maintaining combat readiness.

To identify the major risk factors for dry eye syndrome among military personnel serving in arid climate conditions.

Materials and methods

A cross-sectional observational study was conducted among active-duty military personnel (n=1000) stationed at two military bases located in arid climatic regions. The age of participants ranged from 17 to 50 years, with a mean age of 29.4±6.7 years. Men comprised 82% of the sample, while women accounted for 18%.

All participants completed a standardized questionnaire including demographic data, occupational characteristics, duration of screen exposure, sleep duration, smoking status, allergy history, and environmental exposure factors such as dust, wind, and high temperature [3,6].

Subjective symptoms of dry eye were assessed using the Ocular Surface Disease Index (OSDI©) questionnaire [1]. Clinical ophthalmological examination included slit-lamp biomicroscopy, Schirmer test, and tear breakup time (TBUT) measurement. Dry eye syndrome was diagnosed in participants with OSDI ≥20 and/or TBUT <10 seconds [1].

Environmental and occupational risk factors analyzed in the study included: prolonged screen exposure (>8 hours/day); exposure to wind and dust; low sleep duration (<6 hours/day); seasonal allergies; smoking; exposure to high environmental temperatures and low humidity [6,7].

Statistical analysis was performed using standard biostatistical methods. Quantitative variables were expressed as mean ± standard deviation. Comparisons between groups were performed using Student's t-test and chi-square test. Odds ratios (OR) with 95% confidence intervals (CI) were calculated. Statistical significance was considered at $p<0.05$.

Results

Among the 1000 examined military personnel, signs of dry eye syndrome were identified in 285 individuals (28.5%). The mean OSDI score in patients with DES was 32.1±9.8 points, whereas in participants without signs of the disease it was 14.6±7.4 points ($p<0.001$).

The mean TBUT value in patients with DES was 5.2±1.6 seconds, compared to 11.8±2.3 seconds in individuals without DES ($p<0.001$). Schirmer test values were also significantly lower in patients with DES — 9.2±3.5 mm versus 14.1±4.1 mm in the control group ($p<0.001$).

The most significant risk factors associated with DES were identified as: exposure to wind and dust; screen use for more than 8 hours per day; sleep duration less than 6 hours; seasonal allergies.

Women were affected by DES more frequently than men (42% vs 25%; $p<0.001$). Exposure to high temperature and low humidity also significantly increased the risk of disease development.

Discussion

The present study demonstrated a high prevalence of dry eye syndrome among military personnel serving in arid climate conditions. Nearly one-third of examined individuals met the diagnostic criteria for DES, indicating the substantial influence of occupational and environmental stressors on ocular surface health.

The strongest independent risk factors identified were prolonged exposure to dust and wind, screen time exceeding 8 hours daily, and insufficient sleep duration. These findings are consistent with previous studies showing that environmental stress and digital device use significantly increase tear film evaporation and reduce tear stability [4,6].

Low humidity and high environmental temperature are known to accelerate tear evaporation and contribute to evaporative dry eye disease [7]. Military personnel working in desert and semi-desert regions are particularly vulnerable because of continuous exposure to these climatic conditions during field activities.

Furthermore, prolonged digital screen use reduces blink frequency and increases ocular surface exposure, which worsens symptoms of dry eye syndrome [4]. Similar associations between screen time and DES severity were reported in studies among teachers, children, and office workers [2,4].

Sleep deprivation was also identified as a significant contributing factor. Previous studies have shown that poor sleep quality negatively affects tear secretion and ocular surface regulation [5]. In military personnel, irregular schedules and operational stress likely intensify these effects.

The results emphasize the importance of preventive measures in military settings, including reduction of prolonged screen exposure, optimization of sleep schedules, use of protective eyewear against dust and wind, and early ophthalmological screening programs. Implementation of such strategies may improve ocular health and preserve operational efficiency among military personnel.

Conclusions

The prevalence of dry eye syndrome among military personnel serving in arid climate conditions was 28.5%.

The major risk factors included exposure to wind and dust, prolonged digital screen use, insufficient sleep duration, and seasonal allergies.

Patients with DES demonstrated significantly lower TBUT and Schirmer test values compared to the control group.

The obtained results confirm the necessity of developing preventive measures for military personnel serving in hot and dry climate conditions.

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