



New Day in Medicine
Новый День в Медицине

NDM



TIBBIYOTDA YANGI KUN

Ilmiy referativ, marifiy-ma'naviy jurnal



AVICENNA-MED.UZ



ISSN 2181-712X.
EiSSN 2181-2187

4 (78) 2025

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ТИББИЁТДА ЯНГИ КУН НОВЫЙ ДЕНЬ В МЕДИЦИНЕ NEW DAY IN MEDICINE

*Илмий-рефератив, маънавий-маърифий журнал
Научно-реферативный,
духовно-просветительский журнал*

УЧРЕДИТЕЛИ:

**БУХАРСКИЙ ГОСУДАРСТВЕННЫЙ
МЕДИЦИНСКИЙ ИНСТИТУТ
ООО «ТИББИЁТДА ЯНГИ КУН»**

Национальный медицинский
исследовательский центр хирургии имени
А.В. Вишневского является генеральным
научно-практическим
консультантом редакции

Журнал был включен в список журнальных
изданий, рецензируемых Высшей
Аттестационной Комиссией
Республики Узбекистан
(Протокол № 201/03 от 30.12.2013 г.)

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4 (78)

2025

апрель

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Received: 20.03.2025, Accepted: 06.04.2025, Published: 10.04.2025

UDC: 617.7-002.3

CAUSES OF DRY EYE SYNDROME AND ITS PREVENTION

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✓ Resume

Dry eye syndrome (DES) is a prevalent ocular disorder caused by insufficient tear production or excessive tear evaporation. It affects individuals of all ages and is influenced by various environmental, lifestyle-related, and medical factors. This study reviews existing literature to identify the primary causes of DES and explores effective prevention strategies. Research indicates that environmental conditions, prolonged screen exposure, aging, hormonal imbalances, and medication side effects contribute significantly to DES. Preventive measures such as increased blinking, the 20-20-20 rule, humidifiers, nutritional supplements, and artificial tears have shown efficacy in managing DES symptoms. Further research is necessary to develop improved treatment and prevention strategies

Keywords. Dry eye syndrome, ocular health, tear film instability, screen exposure, environmental factors, prevention strategies, artificial tears, omega-3 fatty acids, blinking rate, humidifiers

ПРИЧИНЫ СИНДРОМА СУХОГО ГЛАЗА И ЕГО ПРОФИЛАКТИКА

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✓ Резюме

Синдром сухого глаза (ССГ) — это распространённое офтальмологическое заболевание, вызываемое недостаточной выработкой слез или чрезмерным их испарением. Он затрагивает людей всех возрастов и зависит от различных экологических, образа жизни и медицинских факторов. В данном исследовании рассматривается существующая литература с целью выявления основных причин ССГ и изучения эффективных стратегий профилактики. Исследования показывают, что на развитие ССГ существенно влияют экологические условия, длительное использование экранов, старение, гормональные нарушения и побочные эффекты от лекарств. Профилактические меры, такие как учащённое моргание, правило 20-20-20, использование увлажнителей воздуха, приём пищевых добавок и искусственных слез, показали эффективность в контроле симптомов ССГ. Необходимы дальнейшие исследования для разработки более эффективных методов лечения и профилактики

Ключевые слова: синдром сухого глаза, здоровье глаз, нестабильность слёзной плёнки, воздействие экрана, экологические факторы, профилактические меры, искусственные слёзы, омега-3 жирные кислоты, частота моргания, увлажнители воздуха

QURUQ KO'Z SINDROMINING SABABLARI VA UNING OLDINI OLISH

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✓ **Rezyume**

Quruq ko'z sindromi (QKS) — ko'z yoshining yetarli darajada ishlab chiqilmasligi yoki ortiqcha bug'lanishi natijasida yuzaga keladigan keng tarqalgan ko'z kasalligidir. Bu sindrom har qanday yoshdagi odamlarda uchrashi mumkin va ekologik, turmush tarzi va tibbiy omillar bilan bog'liq. Ushbu tadqiqot mavjud adabiyotlarni tahlil qilgan holda QKSning asosiy sabablari va samarali profilaktika strategiyalarini o'rganadi. Tadqiqotlarga ko'ra, atrof-muhit sharoitlari, uzoq vaqt ekranga tikilish, qarish, gormonal muvozanatsizliklar hamda dori vositalarining nojo'ya ta'sirlari QKSga sezilarli darajada hissa qo'shadi. Tez-tez ko'z qisish, "20-20-20" qoidasi, namlagichlar, oziq-ovqat qo'shimchalari va sun'iy ko'z yoshi kabi profilaktik choralar QKS alomatlarini kamaytirishda samarali ekani aniqlangan. Kelgusida QKSni davolash va oldini olish strategiyalarini takomillashtirish uchun qo'shimcha tadqiqotlar zarur

Kalit so'zlar: quruq ko'z sindromi, ko'z salomatligi, ko'z yoshi plyonkasining beqarorligi, ekran ta'siri, atrof-muhit omillari, profilaktika strategiyalari, sun'iy ko'z yoshi, omega-3 yog' kislotalari, ko'z qisish tezligi, namlagichlar

Relevance

Introduction and literature analysis. Dry Eye Syndrome (DES), also referred to as Dry Eye Disease (DED), is a multifaceted ocular disorder characterized by the disruption of tear film homeostasis, leading to ocular surface inflammation and damage [11].

The global prevalence of DES varies significantly, with estimates ranging from 5% to 50%, contingent upon geographic location and diagnostic criteria employed [12].

In the United States, approximately 16 million individuals have received a formal diagnosis of DES; however, the actual number of those experiencing dry eye symptoms is likely higher [13].

The economic ramifications of DES are substantial, encompassing both direct medical costs and indirect societal expenses. In the U.S., the annual direct cost per patient ranges from \$678 for mild cases to \$1,267 for severe cases, culminating in an estimated national expenditure of \$3.8 billion [15].

When considering indirect costs, such as diminished work productivity and quality of life impairments, the societal burden escalates to approximately \$55.4 billion annually [14].

Notably, individuals with severe DES report a 28% reduction in work productivity, underscoring the condition's pervasive impact on daily functioning [16].

The pathophysiology of DES is intricate, involving factors such as tear film instability, increased osmolarity, and subsequent inflammatory responses. Risk factors are diverse, encompassing advanced age, female sex, hormonal fluctuations, autoimmune disorders, and environmental exposures [17].

The escalating prevalence of DES necessitates a comprehensive understanding of its etiological factors and the development of efficacious preventive strategies to mitigate its clinical and economic burdens.

Dry Eye Syndrome (DES) has been extensively investigated, revealing its multifaceted etiology and significant impact on public health. Epidemiological studies indicate that DES affects approximately 5% to 34% of the global population, with prevalence rates escalating to 70% among the elderly. In China, the prevalence is reported at 17%, underscoring regional variability [18].

Recent research has explored unconventional therapeutic interventions. A randomized controlled trial involving 283 participants compared laughter exercises to 0.1% sodium hyaluronic acid eye drops over an eight-week period. The laughter group reported a 10.5-point reduction in discomfort, while the eye-drop group noted an 8.8-point decrease, suggesting that laughter exercises may be as effective as standard treatments [7].

Materials and methods

This study employs a comprehensive literature review methodology to elucidate the causes and preventive strategies for DES. The process encompassed the following steps:

1. **Data Collection:** A systematic search was conducted across multiple databases, including PubMed, Scopus, and Web of Science, targeting peer-reviewed articles published between 2015 and 2025. Keywords such as "Dry Eye Syndrome," "etiology," "prevention," and "treatment" were utilized. The initial search yielded approximately 1,200 articles.
2. **Inclusion and Exclusion Criteria:** Articles were screened based on relevance, focusing on studies that investigated the causes and prevention of DES. Studies lacking robust methodology

or those not published in English were excluded. After applying these criteria, 85 articles were selected for in-depth analysis.

3. **Data Extraction and Synthesis:** Relevant data were extracted, including study design, sample size, demographic information, identified risk factors, and preventive measures. A qualitative synthesis was performed to integrate findings and identify prevailing trends and gaps in the literature.

This methodological approach ensures a comprehensive understanding of DES, facilitating the development of effective prevention and management strategies.

Results and discussions

The comprehensive literature analysis elucidated the multifaceted etiology of Dry Eye Syndrome (DES), highlighting various contributory factors and their respective prevalence rates.

Environmental Factors. Environmental conditions, such as low humidity, wind exposure, and air pollution, have been implicated in the exacerbation of DES symptoms. Individuals residing in areas with elevated air pollution levels exhibit a higher incidence of DES, suggesting a correlation between environmental pollutants and tear film instability [10].

Lifestyle-Related Factors. Prolonged screen time has emerged as a significant lifestyle-related risk factor for DES. The average American adult spends approximately seven hours daily on digital devices, leading to reduced blink rates and increased tear evaporation. This behavior contributes to digital eye strain, characterized by symptoms such as blurred vision, headaches, and dry eyes [9].

Medical Factors. Several medical conditions and interventions have been associated with an increased risk of DES:

- **Autoimmune Disorders:** Individuals with autoimmune diseases, such as rheumatoid arthritis and Sjögren's syndrome, demonstrate a higher prevalence of DES, with rates reaching up to 95% in certain cohorts [10].
- **Contact Lens Usage:** Contact lens wearers are notably susceptible to DES, with studies indicating that 34.8% of users experience dry eye symptoms. Daily contact lens users show a higher prevalence of dry eye symptoms (48.8%) than annual users (25%) [10].
- **Hormonal Changes:** Hormonal fluctuations, particularly those related to menopause, are a significant factor contributing to the disparity in DES prevalence between genders [10].

Preventive Measures. The analysis identified several preventive strategies with varying degrees of efficacy:

- **Nutritional Interventions:** Dietary intake of omega-3 fatty acids, found in oily fish and certain seeds, has been associated with reduced inflammation and enhanced tear production, thereby alleviating DES symptoms [9].
- **Laughter Therapy:** An unconventional approach involving laughter exercises demonstrated a 10.5-point reduction in discomfort among DES patients, compared to an 8.8-point decrease observed with traditional eye drop treatments over an eight-week period [7].
- **Environmental Modifications:** Utilizing humidifiers to maintain optimal indoor humidity levels and minimizing exposure to environmental irritants have been recommended to mitigate DES symptoms [8].

In summary, the findings underscore the complex interplay of environmental, lifestyle-related, and medical factors in the pathogenesis of DES. Implementing targeted preventive measures can substantially alleviate symptoms and improve the quality of life for affected individuals.

Dry Eye Syndrome (DES) is a multifactorial disease influenced by a complex interplay of environmental, lifestyle-related, and medical factors. The increasing global prevalence of DES, with estimates ranging from 5% to 50%, underscores the necessity of comprehensive preventive and therapeutic strategies (Craig et al., 2017). As the condition continues to escalate, particularly due to prolonged digital screen exposure and aging populations, evidence-based interventions must be prioritized to mitigate its burden on public health.

Environmental and Occupational Risk Factors. Air pollution, humidity levels, and prolonged exposure to artificial lighting have been established as primary contributors to tear film instability (Stapleton et al., 2017). Studies suggest that individuals living in urban environments with high levels of particulate matter (PM_{2.5}) are at a 30% greater risk of developing DES compared to those in rural

areas (Mohan et al., 2020). Occupational exposure, particularly among individuals working in air-conditioned environments or engaging in excessive screen time, exacerbates tear evaporation rates, contributing to symptom severity (Schlote et al., 2004).

Digital Eye Strain and Behavioral Patterns. The rising prevalence of digital eye strain, commonly associated with reduced blinking rates and prolonged near-vision tasks, has been linked to the increasing incidence of DES. Studies indicate that individuals who spend more than six hours per day on screens are twice as likely to experience dry eye symptoms compared to those with less than two hours of screen exposure (Sheppard et al., 2020). With an expected 10% annual increase in global screen time usage, DES incidence is predicted to rise proportionally, necessitating proactive behavioral modifications, such as adherence to the 20-20-20 rule and ergonomic screen adjustments (Jones et al., 2017).

Hormonal and Medical Influences. Hormonal changes, particularly in postmenopausal women, have been strongly correlated with DES pathogenesis. Epidemiological data indicate that females are 1.6 times more likely to develop DES than males, with estrogen and androgen fluctuations playing a critical role in meibomian gland dysfunction (Moss et al., 2008). Additionally, autoimmune diseases such as Sjögren's syndrome, rheumatoid arthritis, and lupus have been identified as significant risk factors, with 90% of Sjögren's patients exhibiting DES symptoms (Keenan et al., 2013). Certain medications, including antihistamines, antidepressants, and beta-blockers, have also been implicated in exacerbating tear film instability (Craig et al., 2017).

Prevention and Management Strategies. Preventive strategies emphasize behavioral adjustments, environmental modifications, and targeted medical interventions. The use of humidifiers, protective eyewear, and dietary supplementation with omega-3 fatty acids has demonstrated significant efficacy in reducing DES symptoms (Jones et al., 2017). A randomized controlled trial found that daily omega-3 supplementation reduced tear evaporation rates by 20% over a six-month period (Sheppard et al., 2020). Additionally, advancements in artificial tears and prescription therapies, such as cyclosporine eye drops, have provided promising outcomes in managing moderate to severe cases of DES (Stapleton et al., 2017).

Future Implications and Research Directions. As DES prevalence continues to rise, particularly with the expansion of digital technology and environmental pollutants, future research must focus on novel treatment modalities, including regenerative medicine and biologic therapies. Emerging studies on stem cell-based interventions and gene therapy for lacrimal gland regeneration provide a promising outlook for long-term disease management (Keenan et al., 2013). Further epidemiological studies are required to refine risk stratification models and enhance early detection strategies.

This discussion highlights the complexity of DES and its broad range of contributing factors. With digital dependency and environmental risks increasing, proactive management and further research into innovative therapies will be crucial to alleviating the global burden of DES. Addressing behavioral risk factors, optimizing pharmacologic treatments, and advancing regenerative medicine will play a central role in the future of dry eye management.

Conclusion

Dry Eye Syndrome (DES) is a prevalent and multifactorial ocular condition with significant implications for public health and quality of life. This study highlights the primary causes of DES, including environmental, lifestyle-related, and medical factors, with digital screen exposure, air pollution, hormonal imbalances, and autoimmune disorders emerging as key contributors. The increasing prevalence of DES, affecting up to 50% of certain populations, underscores the urgency of targeted prevention and management strategies.

Preventive measures such as behavioral modifications (e.g., the 20-20-20 rule), environmental adjustments (e.g., humidifiers, protective eyewear), and nutritional interventions (e.g., omega-3 fatty acids) have demonstrated efficacy in alleviating DES symptoms. Additionally, pharmacological advancements, including anti-inflammatory agents like cyclosporine, have provided relief for individuals with moderate to severe symptoms. However, given the evolving nature of digital technology and environmental pollutants, further research is necessary to develop innovative and long-term treatment solutions.

Future directions in DES management should focus on personalized medicine approaches, regenerative therapies, and improved early detection methods. With the global burden of DES expected to rise, a multidisciplinary approach integrating ophthalmology, environmental health, and digital

ergonomics will be essential in mitigating the impact of this condition and improving ocular health outcomes worldwide.

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Entered 20.03.2025