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NEÜ YAYINEVİ

Effects of Contact Lens Wearing Habits on Ocular Surface and Microbial Flora

Kontakt Lens Kullanım Alışkanlıklarının Oküler Yüzey ve Mikrobiyal Floraya Etkileri

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Öz

Amaç: Kontakt lens kullanım alışkanlıklarının, bakım önerilerine uyumun ve hijyen alışkanlıklarının sorgulanması ve bunların oküler yüzey ve mikrobiyal kontaminasyon üzerindeki etkilerini incelemek
Hastalar ve Yöntem: Bu prospektif çalışmada 2021-2022 yıllarında kontakt lens bölümümüze başvuran, takipli 108 yumuşak kontakt lens kullanıcısına, kontakt lens kullanımı için riskli kabul edilen davranış ve kullanım alışkanlıkları soruldu. Hastaların son kullandıkları kontakt lensler saklama kapları ile beraber mikrobiyolojik çalışma için laboratuvara gönderildi. Oküler yüzey analizi için oküler yüzey boyanması, göz yaşı kırılma zamanı ve oküler yüzey hastalık indeksi skorlaması yapıldı. Mikrobiyal kontaminasyon ve oküler yüzey analizi ile kontakt lens kullanım alışkanlıkları arasındaki ilişki analiz edildi.
Bulgular: Kliniğimize başvuran kontakt lens kullanıcılarından sadece %6.4 ü tüm kontakt lens kullanım önerilerine uyduğunu bildirdi. Kullanıcıların 72 sinde (%66.7) kültürlerde en az bir üreme olurken, oküler yüzey bozukluğu görülen kullanıcı sayısı ise 60 (%55.6) idi. Kontakt lens ile uyuma (p=0.003) ve lensi belirtilen süreden uzun süre kullanma (p=0.016) oküler yüzey problemlerini arttırıyorken; el hijyenine uymama (p ≤0.001), lens kabı ve solüsyonu belirtilenden uzun süre kullanma (p=0.038) ve solüsyon yerine su kullanmanın (p=0.001) mikrobiyolojik kontaminasyonu arttırdığı gösterilmiştir.
Sonuç: Bu ve bundan önceki çalışmalar göstermiştir ki riskli lens kullanım davranışları oküler yüzey-gözyaşı bozuklukları ve mikrobiyal kontaminasyonu arttıran önemli bir problemdir. Toplumda artan lens kullanımıyla beraber yüksek riskli lens kullanım oranları ciddi oküler patolojileri beraberinde getirebilir.

Anahtar Kelimeler: Kontakt lens, kornea, mikrobiyal kontaminasyon

Abstract

Aim: To question contact lens wearing habits, compliance with care recommendations and hygiene habits and to examine their effects on ocular surface and microbial contamination.
Patients and Methods: In this prospective study, Between 2021-2022, 108 soft contact lens wearers under our follow-up who applied to our contact lens department were asked about their risky contact lens-wearing habits. The last used contact lenses of the patients were sent to the laboratory for microbiological study together with their containers. Ocular surface staining, tear break-up time and ocular surface disease index scoring were used for ocular surface analysis. The relationship between microbial contamination and ocular surface analysis with contact lens wearing habits was analyzed.
Results: Only 6.4% of contact lens wearers who applied to our clinic reported that they followed all contact lens wear recommendations. While there was at least one growth in cultures in 72 (66.7%) of the users, the number of users with ocular surface disorders was 60 (55.6%). While sleeping with a contact lens (p=0.003) and wearing the lens longer than the specified time (p=0.016) increases ocular surface problems; non-compliance with hand hygiene (p ≤0.001), using the lens container and solution for longer than recommended (p=0.038), and using tap water instead of solution (p=0.001) have been shown to increase microbiological contamination.
Conclusion: This and previous studies have shown that risky contact lens wearing habits are an important problem that increases ocular surface-tear film disorders and microbial contamination. With the increasing use of contact lenses in the community, high-risk lens use rates may lead to serious ocular pathologies.

Keywords: Contact lens, cornea, microbial contamination

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INTRODUCTION

Since the end of the 19th century, when they first came into use, contact lens usage have progressively evolved and gained popularity. They are now essential tools for correcting visual impairments due to refractive errors and have been used for therapeutic or cosmetic purposes, especially in developed societies (1). However, their increased usage has also led to a rise in complications.

In addition to being vectors for microbial agents, contact lenses can have mechanical effects on the ocular surface (2). These alterations on the ocular surface result in severe complications such as infectious keratitis. In this case, the microbial agents are most effectively isolated from contact lenses or their containers (3-5). In addition, the use of contact lenses may cause hypoxic, allergic, toxic, and inflammatory reactions in the cornea (6).

Some risky contact lens wearing habits including sleeping with lenses, swimming in the pool, taking a bath, rinsed the lens with tap water, wearing and removing lenses without providing hand hygiene should be avoided as they have been linked to contact lens-related complications (7,8). However, no study has been published about the direct effects of contact lens wearing habits on microbial contamination.

In this study, we aimed to evaluate the direct effects of risky contact lens wearing habits on ocular surface and microbial contamination.

PATIENTS AND METHODS

108 asymptomatic individuals who had been using soft silicone hydrogel contact lenses for at least 6 months and applied to the contact lens department of our hospital for a routine control between 2021 and 2022 were included in this prospective study. The study was conducted in accordance with the Declaration of Helsinki, and local ethics committee approval was obtained (University of Health Sciences, Dışkapı Yıldırım Beyazıt Training and Research Hospital Ethics Committee, 12/06/2017, 39/21).

All contact lens users included in the study were informed about the nature of the study, and gave their informed consent.

The study was initiated by conducting comprehensive ophthalmological examinations on 18-to-40-year-old users who came for a routine contact lens control. Individuals who did not have any systemic diseases or ocular diseases other than refractive errors and who had not undergone any ocular surgery were included in the study. Patients who were taking systemic or ocular medications were excluded from the study.

Risky Contact Lens Wearing Habits

Patients were asked the following queries, which were determined to be risky contact lens wearing habits, and instructed to select either always, sometimes, or never (7)

1. Do you ever sleep with your contact lenses, including at noon?
2. Are there times when you don't wash your hands while putting on or removing your contact lenses?
3. Do you use your contact lens containers or solutions longer than recommended?
4. Do you wear your contact lenses for longer than recommended?
5. Have you ever put your contact lenses in tap water instead of solution or rinsed them with tap water?
6. Do you ever swim or take a bath while wearing your contact lenses?

The questions were asked orally by the same physician. Those who responded "sometimes" or "always" to the questions were considered risky in terms of that habit (7).

Microbiology

The last used contact lenses of the patients along with their containers, were sent to microbiology department. The remaining liquid was completely drained from the lens containers. Cotton swabs soaked with sterile brain heart infusion solution were used to collect samples from inside of the containers and the concave surface of the contact lenses (9). The samples were inoculated on blood agar, chocolate agar, Mac Conkey agar, and Sabouraud dextrose agar, kept under the appropriate conditions for the appropriate amount of time, and then the growths were observed (9).

Ocular Surface-Tear Film Disorders

Ocular surface pathologies were evaluated using the Ocular Surface Disease Index (OSDI), tear break-up time (TBUT), and ocular surface staining, recommended by the Tear Film and Ocular Surface Society (TFOS) as diagnostic tests (10).

OSDI is a test that evaluates various aspects of dry eye symptoms, including severity, impact on daily activities, and impact on quality of life. It consists of 12 questions that assess dry eye symptoms, environmental triggers, and vision-related functions. Each question receives a score between 0 and 4, inquiring about the frequency. A score of 13 or higher is considered significant in terms of dry eye and ocular surface disorders.

For the evaluation of TBUT and ocular surface staining, a drop of saline is dripped onto a paper infused with fluorescein, and the paper is then placed to the lower fornix. Participants are told to blink three times and then look directly ahead without blinking. The time is started immediately after the blink of an eye, and the time of the first tear film break is recorded. The test is administered multiple times, and the average duration was recorded. If the TBUT is less than 10 seconds, it is meaningful. In addition, areas stained with fluorescein are also investigated. Significant staining is defined as five or more spots on the cornea, nine or more spots on the conjunctiva, or stainings longer than 2 mm at the eyelid margin or with a width of at least 25 percent on the eye lid (10).

All tests were performed by a single experinced ophthalmology specialist. A positive result in any of these three tests was considered significant for the participant, in terms of ocular surface-tear film disorders (10).

Statistical Analysis

SPSS (Statistical Package for Social Sciences Inc. Chicago, IL, USA) version 22.0 was used for statistical analysis. The number of participants was determined by a confidence level of 95% (1-α), a test power of 95% (1-β) and an effect size of d=0.5 according to one-tailed independent samples t-test analysis. Logistic multiple regression analysis was used for the risk analysis of the chi-square test results that were significant for the relationship between risky habits and ocular surface problems and the relationship between risky behaviors and growth in microbial culture. A p value of $p \leq .05$ was considered as statistically significant.

RESULTS

Of the contact lens users participating in the study, 44 (40.7%) were male and 64 (59.3%) were female with a mean age of 26.7±9.8 years. The mean lens wearing time was 34.7±9.5 (6-120) months. Only 6.4% (n=7) of the users who participated in the study stated that they avoided risky habits completely (Table 1). While there was at least one growth in cultures in 72 (66.7%) of the users, the number of users with ocular surface disorders was 60 (55.6%). In cultures, Staphylococcus (23.1%; n=25), Bacillus (17.5%; n=19), and Micrococcus (10.1%; n=11) were the most common species (Figure 1).

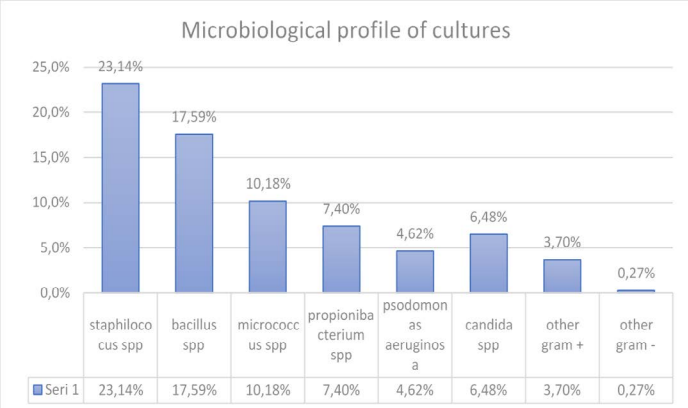

Figure 1. Species and ratio of microorganisms isolated from culture

While sleeping with a contact lens and wearing the contact lens longer than the recommended time are considered risks for ocular surface disorders; Non-compliance with hand hygiene recommendations, using the contact lens solution or container for longer than the recommended time, replacing the solution with tap water or rinsing the lens in tap water were determined to be risky in terms of microbial contamination (Table 2-4).

DISCUSSION

In this study, we evaluated the compliance of contact lens wearers who applied to our clinic to the lens wearing rules, as well as the effects of this compliance on the ocular surface and microbial biological load. In our study, more than 90% of

Table 1. Prevalence of risk behaviors for contact lenses

Risk factor/Behavior	Participant Ratio
Sleeping with contact lenses	%55.6 (n=60)
Non-compliance with hand hygiene recommendation	%47.2 (n=51)
Using the lens container-solution longer than recommended	%61.1 (n=66)
Replacing lenses at intervals longer than recommended	%66.6 (n=72)
Storing lenses in tap water or rinsing lenses in tap water	%59.3 (n=64)
Swimming or taking a shower in contact lenses	%34.2 (n=37)
Any risk behavior	%93.6 (n=101)

Table 2. The relationship between risk behaviors for contact lenses and ocular surface disorders and microbial contamination

	Ocular surface disorders (p* value)	Microbial contamination (p* value)
Sleeping with contact lenses	0.003	0.146
Non-compliance with hand hygiene recommendation	0.083	≤0.001
Using the lens container-solution longer than recommended	0.22	0.038
Replacing lenses at intervals longer than recommended	0.016	0.082
Storing lenses in tap water or rinsing lenses in tap water	0.123	0.001
Swimming or taking a shower in contact lenses	0.096	0.53

* chi-square test

Table 3. Regression Analysis: Relationship between bacterial growth and risk behaviors for contact lenses

	Odds ratio	95% confidence interval	p
Non-compliance with hand hygiene recommendation	3.5	3.1-3.8	≤0.001
Using the lens storage case-solution longer than recommended	1.3	1.1-1.7	0.02
Storing lenses in tap water or rinsing lenses in tap water	2.1	1.6-2.7	≤0.001

Table 4. Regression Analysis: Relationship between ocular surface disorders and risk behaviors for contact lenses

	Odds ratio	95% confidence interval	p
Sleeping with contact lenses	2.5	2.1-3.1	0.001
Replacing lenses at intervals longer than recommended	1.7	1.1-1.7	0.016

participants reported doing at least one risky contact lens wearing habits, whereas in the study by Cope et al. (7) this rate was approximately 85%. In another study conducted by Ibrahim et al., the rate of sleeping with contact lenses was approximately 10%, compliance with hand hygiene regulations was approximately 17%, and other risky habits were comparable to our findings (11). Additionally, the rates were lower in an Australian study compared to ours (12). Considering the "sometimes" option as risky in our research and Cope's study may have affected these rates. In other studies, the responses to the questions were interpreted as "yes" or "no"; however, we think that people do not always adhere to such strict boundaries when it comes to following the rules.

When we look at the growths in culture, microbiological agents that often grew in the samples obtained from contact lenses and their containers compatible with the normal flora. Although their reproduction rates and rankings are different in studies, staphylococcus, bacillus, and micrococci are the most frequently obtained microorganisms as in our study and are the organisms that detected mostly on the soft contact lenses (13). The corneal surface is normally regarded as sterile, whereas the conjunctival flora contains the majority of microorganisms. Colonization of contact lenses is also important because it has been linked to lens-related infiltrates and inflammatory conditions besides keratitis (14). In similar studies, the contamination rates as a result of cultures taken from contact lenses and their containers are close to 80% (13). Our research revealed that poor hand hygiene and improper use of lens solution are directly related to the colonization of microorganisms on contact lenses and their containers. Wu et al. (15) demonstrated that contact lens and container contamination occurs when the containers and hand hygiene recommendations are neglected. Yung et al. (16) also drew attention to the risks of contamination, such as using the lens solution for longer than the recommended time or replacing the lens solution with tap water.

Contact lens-related ocular surface disorders are important in terms of contact lens compliance and contact lens-related complications, and they can lead to contact lens discomfort and even contact lens dropout (17). In our study, we noticed that the incidence of ocular surface problems increased

significantly when contact lenses were worn overnight and for longer than recommended. The sleeping with contac results in corneal hypoxia, and prolonged lens wear causes corneal surface problems due to the accumulation of deposits (18). Tear changes and increased inflammatory cytokines in patients who slept with contact lenses have also been shown in previous studies (19). As a result, risky contact lens wearing habits create a suitable environment for keratitis, one of the most serious complications, and threatens the ocular surface, which serves as a barrier against these complications.

Risky contact lens wearing habits are quite common and their prevalence must be decreased. Despite the fact that many factors influence these habits, education is one of the most essential tools for changing them, which was demonstrated by Lam et al. (8) When prescribing contact lenses in ophthalmology clinics with a high patient volume, informing the patient about the use of contact lenses can be skipped. At least once every six months, contact lens wearers should visit an ophthalmologist, who should enlighten and encourage them to avoid risky contact lens wearing habits.

The study has numerous limitations. First, the study was based on the patients' self-reports, and there were no risky habits frequency categories. Second, there were no groups of reproductive severity by culture. In addition, the growths in the contact lenses and their containers were assessed as a single entity and not separately classified and analyzed. The absence of data analyzing the type of microorganism and the associated risky habit is another limitation of the study.

In conclusion, the study revealed that risky contact lens wearing habits increase the likelihood of contact lens complications and ocular surface disorders. In order to reduce contact lens-related complications, patient education and correction of risky habits are crucial.

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