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Original paper

Underestimated risks for bacterial keratitis in contact lens usage

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Abstract

Objective: The purpose of our research is to emphasize the role of underestimated predisposing conditions for microbial keratitis in contact lens users, to draw attention to the complications of wearing contact lenses without ophthalmic examination, and to offer a short questionnaire for fast and easy estimation of the risk factors for bacterial keratitis.

Methods: A series of 23 cases of healthy young individuals, treated for bacterial keratitis, provoked a research on the predisposing factors for its development.

Results: 55% of the patients had started to wear contact lenses without specific examination. 75% had made mistakes in the hygiene and storage of the lenses. We identified risk factors for development of bacterial keratitis in all cases.

Conclusions: A thorough anamnesis and ophthalmic examination are crucial in decision making about contact lens wearing because they could reveal some of the predisposing conditions for the occurrence of ocular complications. The usage of contact lenses without a prescription poses health risks and could have a negative impact on the social and healthcare system.

Keywords Bacterial keratitis, Complications, Risk factors, Soft contact lenses.

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Introduction

Bacterial keratitis (BK) is a serious ophthalmic disease that is the major cause of corneal blindness. (WHITCHER et al, 2001) Persons with underlying ocular and systemic conditions show predisposition to the disease (KEAY et al, 2009), (ZIMMERMAN et al, 2016) Table 1.

The major risk factor for BK in persons without systemic diseases is contact lens usage, with annualized incidence from 0.02 to 0.25%. Studies estimate that the highest incidence occurs in overnight usage (ZIMMERMAN et al, 2016), (STAPLETON et al, 2008), (MCVEIGH et al, 2017), (PINNA et al, 2011), (DART et al, 2008), (SZCZOTKA-FLYNN et al, 2007). Additional risk factors are poor hygiene, use of unregulated lenses without a prescription, lens sharing, swimming, showering, or a hot tub using with soft contact lenses (SCL), male sex, younger age (DART et al, 2008), (MORGAN et al, 2005) smoking, and higher socioeconomic class (PINNA et al, 2011), (SAUER et al, 2011).

Table 1. Local and systemic risk factors

Local conditions	Systemic conditions
corneal trauma, contact lens wearing, especially incorrect use of topical medications, especially steroids, eyelid disorders, chronic ocular surface disease, allergic ocular conditions, abnormal corneal surface, ocular surgery	poor general health, malnutrition, diabetes, thyroid disease, connective tissue diseases, sarcoidosis, immunocompromised states, dermatologic disorders, atopy

Symptoms of bacterial keratitis may include edema of the eyelids, redness, blepharospasm, photophobia, excessive tearing, discharge, diffuse injection of the bulbar conjunctiva, corneal infiltrates, ulcerations, anterior chamber reaction, reduced vision, and pain in the eye (MASCARENHAS et al, 2014), (BOURCIER et al, 2003). The major causative microorganisms of bacterial keratitis are *Staphylococcus aureus* (27%), *Pseudomonas aeruginosa* (15%), and *Serratia marcescens* (11.2%), along with a range of bacteria and fungi . *Serratia marcescens* (SM) is the most common bacterial isolate in cases of SCL-related BK (DAS et al, 2007). The differential diagnosis includes fungal, viral, acanthamoeba, marginal, non-infectious, and microbial keratitis, so clinical samples need viral, bacterial, and chlamydial analysis. It is important to perform microbial culture of the lenses, solutions, lens case and the conjunctival swab.

In our routine practice, we have been receiving an increasing number of patients in the ophthalmology office or department with complaints provoked by contact lens wearing, even worse, with complications from their usage without prescription. Not surprisingly, based on economic and logistic reasons, there is an ever growing number of persons who purchase contact lenses, whether cosmetic or dioptric, from internet-based stores, optician shops, and elsewhere without an ophthalmic examination, prescription, fitting, instructions, and training in contact lens care. These findings and a series of BK cases examined and treated in a private ophthalmology practice focused our attention on the disease. The purpose of our work is to emphasize the predisposing factors for BK and the underestimated risks for personal health and the healthcare system of the usage of soft contact lenses without specific examination and to offer a short questionnaire for fast and easy estimation of the risk factors for bacterial keratitis.

Methods

A series of 23 cases of healthy young individuals treated for bacterial keratitis for five months in an ambulatory ophthalmology practice in Sofia, Bulgaria, provoked detailed research in the literature for predisposing factors and conditions for its development. All the patients underwent a thorough ophthalmic examination including best-corrected visual acuity test, slit-lamp biomicroscopy, tonometry, and fundoscopy. A conjunctival swab was taken and contact lenses, lens cases, and solutions were sent for microbiolocial analysis. The patients provided their medical history and described their habits. To estimate the risk factors, we made a short questionnaire with the major predisposing conditions for BK and asked each patient to complete it (Table 2).

Table 2. Risk factors for BK in SCL usage

Local conditions	Systemic conditions
Eyelid disorders Chronic ocular surface disease Giant papillary conjunctivitis Allergic ocular conditions Abnormal corneal surface Previous ocular surgery	Diabetes, Thyroid disease, Connective tissue diseases, Sarcoidosis Immunocompromised states, Dermatologic disorders, atopy
Risk Factors	
Smoking Work with video displays (period of use)	Use of topical medications Working in dirty/ dry conditions
Contact lens usage and care	
Were the lenses prescribed and fitted A regimen of lens wearing Period of daily usage Overnight wearing Type of lens material and period of usage	Type of lens solution Hand hygiene Lens care Lens case hygiene and exchange Usage of lenses in wet conditions

Results

All the patients were younger than 40 years without systemic diseases, 13 males, and 10 females. Two patients reported an ocular trauma a few days prior, and the examination found erosions with superposed infection. One patient had bacterial blepharoconjunctivitis with punctate keratitis. These three persons received adequate topical therapy and achieved a fast resolution.

The other 20 patients were regular contact lens users, 11 males, and 9 females. All contact lens wearers reported a red eye, tearing, discharge, and photophobia. 7 persons had noticed “white dots” on their corneas, and 8 reported better comfort while wearing their lenses. Upon examination, we found a diffuse conjunctival injection with one or multiple corneal infiltrates and overlying erosions. Treatment initiated with frequent applications of broad-spectrum topical antibiotics.

The causative agent was isolated in all cases. The microbial culture tests showed different results in different test materials (conjunctival swab, contact lens, and lens case or solution) from one and the same patient. The microbial analysis of the conjunctival swab test was negative in 30%, but a bacterium was isolated from the lens, lens case, or solution. Antibiograms were done. The rapid identification of the causative microorganism for bacterial keratitis ensured etiological therapy with a good clinical outcome. After the treatment, the visual acuity with correction in all the cases was 20/20.

The medical history, anamnestic data, and detailed conversations with the patients about the risk factors for BK revealed some predisposing conditions for the disease. Eleven persons, 55%, had not passed a specific ophthalmic examination and had started to use contact lenses without a prescription and instruction, buying them from optician shops or online. Most individuals, 70% (n= 14), including those with prescribed SCL, reported that they had never been interviewed about their habits and daily routines. 50% (n=10) were smokers, 55% (n=11) reported working with electronic devices for over 8 hours a day, 45% (n=9) had allergic conditions, 20% (n=4) regularly used topical antihistamines or corticosteroids, and 40% (n=8) reported working in a dirty/dry/hot environment. 75% (n=15) showed some errors in the SCL hygiene, regimen, and storage; 10% (n=2) had poor hand hygiene; 30% (n=6) had slept sometimes with lenses; 60% (n=12) were generally overwearing lenses, using them more than 15 hours a day, or over their period of usage, and 55% (n=11) had not changed the multipurpose solution in the lens container regularly and had not been leaving the container to dry.

Discussion

Our findings and clinical experience confirm that it is necessary to take samples for microbiological analysis and microbial culture, especially in cases with fast progression and insufficient response to broad-spectrum antibiotic therapy, mainly in contact lens wearers who are more predisposed to bacterial keratitis and who usually have compromised anterior ocular surface and lower corneal sensitivity. The difference in the results of microbiological cultures from the conjunctiva swabs, contact lenses, lens cases, and the solution emphasizes the need to analyze all these materials. We recommend microbiological culture from different materials to become a regular practice in

cases of contact lens-related bacterial keratitis to ensure etiological treatment and better prognosis with a good visual outcome for the patient.

70% of our patients reported that they had never been asked about local and systemic risk factors, including those who were specifically examined for contact lens usage.

Our short questionnaire focused on the risk factors and revealed that 50% of the group were smokers, which entails a 3-fold higher risk (EVANS et al, 2013); 10% had poor hand hygiene (13-fold increased risk) (DART et al, 2008), 45% had allergic conditions (LIM et al, 2016); 20% reported regular use of local therapy; 55% reported working with electronic devices; 40% worked in a dirty/dry environment; 75% had errors in lens hygiene, regimen, and storage; 30% had slept sometimes with lenses, 60% generally were overwearing lenses.

Despite the comfort of SCL for visual correction, their prolonged use, especially overnight, increases the chances of complications (e.g. bacterial keratitis). It is essential for patients to understand the importance of good hand and lens hygiene and the necessary methods to minimize the risk of infection. Daily contact lenses could be a better option (STAPLETON et al, 2008), (RAHIMI et al, 2009), (MAH-SADORRA et al, 2005), (LIN et al, 2019), (STAPLETON et al, 2012).

A thorough anamnesis and detailed ophthalmic examination are crucial in decision making about SCL wearing because they could reveal some of the many predisposing factors for microbial keratitis and other ocular complications that are not obvious at a routine examination. The advantages, disadvantages, and possible complications should be explained to a patient before prescribing soft contact lenses. Correct fitting, instructions for wearing, and care of SCL are required before use.

Unexpectedly, the majority of the patients were not familiar with the correct lens usage and care. 55% of them had started to use SCL without a prescription and their number would probably continue to rise. However, the health risks of such actions are not to be ignored.

Our short questionnaire could be useful for ophthalmologists and optometrists to facilitate their practice. The first two sections could be used to estimate the risk factors before prescribing SCL. The whole form could be valuable in cases with SCL-related complications to highlight the probable predisposing conditions.

Conclusion

Contact lens usage is not a cosmetic measure, rather, it is a healthcare decision that could result in medical complications if its risks are underestimated. The easy access to SCL purchasing, especially anonymously on Internet-based platforms, could lead to long-term personal and social consequences. Thus, unsupervised contact lens fitting, selling, and usage is a problem that needs attention. Different information campaigns directed toward the wider society and proper regulatory measures could be beneficial in preventing complications and would contribute to the individuals' health.

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Abbreviations

BK= Bacterial keratitis, SCL= Soft contact lens

Conflict of Interest

The authors have no conflict of interest to declare.

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