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*Asymptomatic and symptomatic ocular infections  
related to contact lens wearing*

Ocular infections are one of complications of contact lens wearing. They may be caused by different factors such as: bacteria, viruses, fungi and protozoa. Most pathologies related to contact lens wearing occur in the anterior segment of the eyeball and clinically can be seen as serious inflammation. Nevertheless, using contact lenses without any coexisting symptoms is not univocal to their sterility and may also be a source of infection. The factors causing infectious complications are connected with hygiene negligence, such as: improper disinfecting of contact lenses, usage of contaminated lenses, contact lens containers and cleaning solutions, wearing contact lenses during eye infections, contamination of contact lenses through introduction of microorganisms from the environment (18).

ASYMPTOMATIC INFECTIONS

Lack of infection symptoms during contact lenses wearing is not univocal to their sterility. Even if the rules of hygiene are restricted properly, there are still microorganisms on the surface of the conjunctivae and the lens, that can become the source of infection. The most frequently recognized pathogens are the following bacteria (18): *Staphylococcus epidermidis*, *Staphylococcus aureus*, *Streptococcus pneumoniae*, *Streptococcus viridans*, *Pseudomonas aeruginosa*, *Haemophilus influenzae*, *Serratia marcescens*, *Escherichia coli*; viruses: *Herpes simplex*, *Varicella zoster*; fungi: *Aspergillus* sp., *Candida* sp., *Cryptococcus*; rickettsia: *Chlamydia trachomatis*. Willcox and al. (19) examined the potential sources of the bacteria that colonize contact lenses. The likely route for the normal ocular microbiota colonizing contact lenses (especially coagulase-negative *Staphylococci*) is via the lid margins, whereas colonization by Gram-negative bacteria (*Enterobacteriaceae* and *Pseudomonadaceae*) is likely to come from the domestic water supply. Studies in asymptomatic patients using 30-day continuous-wear silicon hydrogel contact lenses suggest that the sterility of their conjunctiva significantly decreased. Iskeleli et al. (7) admitted that the number of eyes with a growth of coagulase-negative *Staphylococci* and *Diphtheroid* rods in their conjunctival cultures significantly increased after using these lenses. Conversely, a statistically significant difference was not found in the number of eyes that carried *Propionibacterium acnes* and *Fusobacterium nucleatum* in their conjunctival cultures before and after using 30-day continuous-wear silicone hydrogel lenses. Ahantou et al. (1) isolated from extended-wear soft contact lenses coagulase-negative *Staphylococci*

in 74%. *Serratia marcescens* was found at an incidence of 10%, and *Pseudomonas aeruginosa* at an incidence of 6%. Next investigations of bacteria isolated from the lenses in asymptomatic patients revealed the presence of bacteria on the surface of 31.3% examined lenses (4). The bacteria isolated from these lenses were: *Staphylococcus epidermidis* (four lenses), *Staphylococcus aureus* (two lenses), *Staphylococcus epidermidis* and *Klebsiella oxytoca* (two lenses), *Enterobacter cloacae* (two lenses), *Serratia liquefaciens* (one lens). The growth from 70% of lenses was barren.

#### SYMPTOMATIC INFECTIONS

Symptomatic infections may be caused by bacteria, viruses, fungi and protozoa. Bacterial infections that cause conjunctivitis and keratitis are the most frequent ones. The incidence rates for bacterial microbial keratitis range from approximately 2/10,000 per year for rigid contact lens, 2.2–4.1/10,000 per year for daily-wear soft contact lens, to 13.3–20.9/10000 per year for extended-wear soft contact lens (9). Using of the contact lenses is the cause of 19–42% bacteriologically confirmed keratitis (17). The risk of keratitis significantly increases (about 15 times) in patients who sleep in contact lenses and is correlated with the number of days without putting off the lenses (3, 17). Many authors suggest that the pathogen which causes keratitis most frequently is *Pseudomonas aeruginosa* (5, 10, 11). Clinical symptoms of ulcerative keratitis are: pain, conjunctivitis, photophobia, worsening of vision acuity. *Pseudomonas aeruginosa* usually causes liquefactive necrosis of proper substance of the cornea with irregular surface and presence of thick mucous-purulent secretion, intraepithelial inflammatory precipitates, and inflammatory reaction in anterior chamber (17). Neumaer et al. (12) examining corneal infiltrates and ulcers found in 56% of eyes keratitis caused by contact lenses wearing. Bacteria were found in 53% of the examined cases, mainly Gram-negative bacteria such as: *Serratia* sp., *Pseudomonas* sp., *Stenotrophomonas maltophilia*, *Klebsiella oxytoca*. Viral infections occur rather seldom and may be mainly caused by *Herpes simplex* and *Herpes zoster* virus. What's more, during contact lenses wearing patients are more vulnerable to adenovirus infections which cause keratoconjunctivitis epidemica. These infections cause epithelial erosions of pointed or dendritic shape, diminishing of corneal perception, submandibular and parotid lymphadenopathy (17). Fungal keratitis as a complication of contact lenses wearing is most frequently caused by corneal trauma. These infections are usually caused by *Fusarium* sp. Most characteristic symptoms are infiltrations with irregular, ragged edges with satellite ulceration. Amoebic keratitis (caused by *Acanthamoeba*) occurs rather seldom, but most of the cases (70%) are connected with contact lenses wearing. Frequency of infections in contact lenses wearers is estimated at 1/25000 (8). Infection is connected with improper disinfecting of lenses (home-made physiological solution, contamination of contact lens container). The reason may be also contaminated water from domestic water supplies or from swimming pools. Development of infection may last a couple of weeks. Patients often complain of pain much stronger than the clinical symptoms would suggest, increasing after eye rubbing. Clinically the inflammation is seen as a pointed or dendritic epitheliopathy. Well visible circle infiltration in the central part of the cornea is a late symptom. The risk of transmission of prions by contact lenses was also estimated (6). The interest in prions increased with Creutzfeldt-Jakob disease. One case of transmission of prions by the corneal graft was noted. The prions were also found in corneas of animals. Nevertheless, the assessment of risk of transmission of prions by contact lenses is as yet negligible.

## CONTACT LENS TYPES VERSUS EYE INFECTIONS

Daily disposable soft contact lenses theoretically show a lower risk of infectious keratitis compared with other lens wear regimens. Nevertheless, some risk always remains. Su et al. (16) present two case reports of individuals who developed infectious keratitis while wearing daily disposable soft contact lenses. In the first case cultures grew *Pseudomonas aeruginosa*, in the second case – *Staphylococcus aureus*. Other authors examined microbial changes in conjunctival flora in asymptomatic patients who used 30-day continuous-wear silicon hydrogel contact lenses (7). They concluded that the sterility of the conjunctiva significantly decreased. The number of eyes with a growth of coagulase-negative *Staphylococci* significantly increased after using these lenses. And what's more, the number of bacteria of the normal conjunctival flora also significantly increased. Contamination by the bacteria of the eyelids may be a possible colonization factor in this study group. Stapleton et al. (15) compared the risk of microbial keratitis for extended wear soft contact lens users, rigid gas permeable and daily wear soft contact lens users. The relative risk of microbial keratitis for extended wear soft contact lens users was 36.8 times that of rigid gas permeable contact lens users, while the relative risk of sterile keratitis among extended wear soft lens users was 4.6 times that of rigid gas permeable lens users. For daily wear soft contact lens users the relative risk of microbial keratitis was 4.2 times that of rigid gas permeable lens wearers. For sterile keratitis the relative risk was 2.3 times greater than rigid gas permeable contact lens users. The materials used to construct contact lens may influence subsequent bacterial adhesion events and may have important meaning in occurrence of complications. Many authors suggest that contact lens made from nonionic polymers with high water content (>50%) may carry higher risk of bacterial contamination because bacteria have the ability to adhere preferentially to their surface (2). The lenses made from nonionic polymer with <50% water content bound the fewest bacteria. It seems that high oxygen transmissibility (Dk/t) lenses may reduce the risk of microbial keratitis, compared to low Dk/t lenses (13). Ophthalmology Times (14) marks that the future of contact lenses lies in anti-bacterial daily disposable lenses that would prevent eye infections. The elaborated technology would not eradicate bacteria but would prevent them from colonizing lens surface.

It is important to point out that besides all possible causes of eye infections related to lens wearing, the major prophylactic measure remains proper hygiene habits. Contact lens wearing should undergo periodical control by appropriately trained ophthalmologist.

## REFERENCES

1. A h a n t o u E. et al.: Association of *Pseudomonas aeruginosa* and *Serratia marcescens* with extended-wear soft contact lenses in asymptomatic patients. CLAO J., 28 (3), 157, 2002.
2. D a n g Y. et al.: Quantifying *Pseudomonas aeruginosa* adhesion to contact lenses. 1. Eye & Contact Lens: Science & Clinical Practice, 29 (2), 65, 2003.
3. E f r o n N. et al.: Incidence and morbidity of hospital-presenting corneal infiltrative events associated with contact lens wear. Clin. Exp. Optom., 88 (4), 232, 2005.
4. G r a ł e k M.: Flora bakteryjna miękkich soczewek kontaktowych. Kontaktologia i Optyka Okulistyczna, 2, 29, 2003.
5. G r u n a u e r - K o e v e k o r n C. et al.: Nosocomial *Pseudomonas aeruginosa*-associated keratitis in soft contact lens wearer. Klin. Monatsbl. Augenheilkd, 221(1), 52, 2004.
6. H o g a n R. N.: Potential for transmission of prion disease by contact lenses: an assessment of risk. Eye Contact Lens, 29 (1 Suppl), 44, 2003.

7. Iskeleli G. et al.: Microbial changes in conjunctival flora with 30-day continuous-wear hydrogel contact lenses. *Eye & Contact Lens: Science & Clinical Practice*, 31 (3), 124, 2005.
8. Langwińska-Wośko E. et al.: Powikłania po stosowaniu miękkich soczewek kontaktowych. Część II. Omówienie rodzajów spotykanych powikłań. *Kontaktologia i Optyka Okulistyczna*, 1, 7, 2003.
9. Liesegang T. J.: Contact lens-related microbial keratitis: Part I: Epidemiology. *Cornea*, 16 (2), 125, 1997.
10. Mah-Sadorra J. H. et al.: Trends in contact lens-related corneal ulcers. *Cornea*, 24 (1), 51, 2005.
11. Mela E. K. et al.: Ulcerative keratitis in contact lens wearers. *Eye Contact Lens*, 29 (4), 207, 2003.
12. Neumaier-Ammerer B. et al.: Corneal infiltrates and ulcers. A retrospective study of 239 eyes. *Ophthalmologie*, 101 (1), 33, 2004.
13. Nilsson S. E.: Bacterial keratitis and inflammatory corneal reactions: possible relations to contact lens oxygen transmissibility: the Harold A. Stein Lectureship, 2001. *CLAO J.*, 28 (2), 62, 2002.
14. *Ophthalmology Times*, Jul. 15, 2005.
15. Stapleton F. et al.: Risk factors with contact lens related suppurative keratitis. *CLAO J.*, 19 (4), 204, 1993.
16. Su D. et al.: Infectious keratitis associated with daily disposable contact lenses. *Eye & Contact Lens: Clinical Practice*, 29 (3), 185, 2003.
17. Szaflik J. (red): *Choroby aparatu ochronnego oka i rogówki*. BCSC 8. Wyd. Med. Urban & Partner, Wrocław 2003.
18. Szymankiewicz S.: Objawy i syndromy patologiczne związane z noszeniem soczewek kontaktowych. *Kontaktologia i Optyka Okulistyczna*, 2, 7, 2003.
19. Willcox M. D. et al.: Potential sources of bacteria that are isolated from contact lenses during wear. *Optom. Vis. Sci.*, 74 (12), 1030, 1997.

## SUMMARY

The article presents a review of the literature concerning both: symptomatic and asymptomatic ocular infections, being the complications of contact lens wearing. Special attention was paid to the most important factors that cause complications and to the sources of infection. The pathogens among bacteria, viruses, fungi and protozoa that occur most frequently have been discussed. The correlation between infection and contact lens types has been found.

### Bezobjawowe i objawowe infekcje oczne po stosowaniu soczewek kontaktowych

W pracy poglądowej zawarto dane z literatury, dotyczące zarówno objawowych jak i bezobjawowych infekcji ocznych będących powikłaniami stosowania soczewek kontaktowych. Zwrócono szczególną uwagę na najważniejsze źródła zakażenia i czynniki sprzyjające powikłaniom. Przedstawiono najczęściej występujące patogeny spośród bakterii, wirusów, grzybów i pierwotniaków. Odnotowano zależność pomiędzy występowaniem infekcji a typem stosowanych soczewek kontaktowych.