

Bacterial Contamination Among Soft Contact Lens Wearer

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Purpose: To study the potential risks of acquiring microbial keratitis among soft contact lens wearer.

Methods and Material: This prospective study was conducted from Feb. 2005 to Jan. 2006. Samples were taken from contact lenses, contact lens storage cases and conjunctiva using sterile cotton swabs moistened with normal saline solution under aseptic condition. Each swab obtained was inoculated into separate tubes with brain heart infusion (BHI) broth. Inocula in BHI broth were incubated at 37°C for 24 hours. Obtaining an inoculum from the incubated BHI broth and gently streaking it on blood agar, MacConkey's agar, cetrimide agar, Vogel-Johnson's agar and nutrient agar did bacterial isolation. Bacterial culture obtained was identified using Gram's staining, performing biochemical testing and on the basis of culture diagnosis by growing on selective media.

Results: During the present study, out of hundred contact lens wearer, 65%, 89% and 32% had their contaminated contact lenses, lens storage cases and conjunctiva, respectively. Over all staphylococcus epidermidis was found to be the most frequent contaminant (39.8%) and pseudomonas aeruginosa was found to be next dominant organisms (34.9).

Conclusions: The major factor, which contributes to the infections among the contact lens wearer, is the contamination in their contact lens care system. Pseudomonas infection is the most prevalent among contact lens wearer contact lens care system.

Microbial keratitis is the most serious complication associated with soft contact lens usage¹. It involves the entry and subsequent invasion of the corneal layers by the offending pathogens, which include structural as well as enzymatic components in which are responsible for the attachment of different bacteria to the cornea. As a result of increase stress imposed by the contact lenses on the cornea, the later is less able to defend itself against invading bacteria. Thus, the bacterium

effectively manages to overcome the eye's weakened defenses, precipitating a fulminant infection².

P aeruginosa is the most frequent bacterial contaminant of contact lens care system, next are S epidermidis, Staphylococcus aureus, Coagulase negative Staph³, Fungi, protozoa (Acanthamoeba) and viruses may also cause similar infection.

A major factor that may be responsible for the development of keratitis among contact lens users is the microbial contamination of their lens care system.

The lens care system includes the ophthalmic solution, lens cases and lenses used by the contact lens wearer. Furthermore, several reported cases of such ocular infections have been implicated to be due to lens care system contamination. This may be attributed to improper cleaning of the contact lenses as well as the presences of contamination in the other items of lens care system. Contamination of the lens cases or lens care solutions would most likely contaminate the contact lenses⁴.

The present study is aimed at determining the potential risk of acquiring microbial keratitis among soft-contact-lens wearer in university student population by screening their contact lenses, storage cases and swabs from their conjunctival epithelium for the presence of bacteria.

MATERIAL AND METHOD

The sample population was the Faculty of Pharmacy, University of Karachi, undergraduate students wearing soft contact lenses. The reason for such choice was the accessibility of the subjects. Only students using soft contact lens were considered subject volunteers, who had established a routine pattern of lens care. The participants were required to complete a questionnaire, which consisted of systematic question regarding type of lens, age, sex, wearing schedule as well as disinfection schedule. The study was prospective study and the study period was 12 months from Feb 05 to Jan 06.

For sampling, the contact lenses were swabbed with sterile cotton swabs moistened with sterile normal saline solution. To take sample from eyes, sterile cotton swab was moistened with sterile normal saline solution and conjunctival epithelium was swabbed with it. Each swab obtained was inoculated into separate tubes with brain heart infusion (BHI) broth. Inocula in BHI broth were incubated at 37°C for 24 hours. Obtaining an inoculum from the incubated BHI broth and gently streaking it on blood agar, MacConkey's agar, Cetrimide agar, Vogel-Johnson's agar and nutrient agar did bacterial isolation. Plates were then incubated at 37°C. Cultures were considered negative if no growth was detected within 48 hours of incubation. Bacterial culture obtained was identified using Gram's staining, on the basis of culture diagnosis by growing on selective media and performing biochemical test including catalase, coagulase, and oxidase.

The percentage contamination for each item of the lens care system and conjunctiva, and the frequency of occurrence of each bacterium were calculated after pooling all data. Z-test (Hypothesis Testing Between Proportions) was employed to determine significant difference between calculated proportions.

RESULTS

Out of hundred contact lens wearers, 65%, 89% and 32% had contaminated contact lenses, lens storage cases and conjunctiva, respectively. *S. epidermidis* 44.6%, *P. aeruginosa* 35.4%, *S. aureus* 12.3% and *Bacillus* species. 7.7% were isolated from contact lenses. *P. aeruginosa* 41.6%, *S. epidermidis* 28%, *Escherichia coli* 12.4%, *Bacillus* species 10% and *S. aureus* 5.6% were isolated from contact lens storage cases. *S. epidermidis* 40.6%, *P. aeruginosa* 31.2%, *S. aureus* 9.4% and *Bacillus* species 6.3% were isolated from conjunctival swabs from contact lens wearer.

DISCUSSION

In third world countries, lack of basic amenities provides a breeding ground for geometrical progression of multifarious organisms in water, air and soil. Normal conjunctival flora is either exogenous or endogenous in origin, which can be contracted from environment, physical contact or unhygienic habits of people. One of the physical contact is the use of contact lenses and also the unhygienic maintenance of the lenses. During this study a randomized sample of 100 normal looking eyes using contact lenses were subjected to bacteriological study, in order to investigate the possible contaminants of soft contact lenses, to identify pathogenic as well as non-pathogenic microorganisms, (Table 1-4).

It has been observed that 89% and 65% subjects had contaminated contact lens storage cases and contact lenses, respectively. The presence of contamination places the study group subjects at risk, since contamination of the lens care system as a major factor in the occurrence of eye infections among soft contact lens wearer. The high percent are contamination of lenses of the subjects can be attributed to the contamination in other items of the lens care system. During the present study, it was observed that 89% contact lens cases were contaminated. These result are significantly higher ($P < 0.05$) then reported in 1996 i.e. 57.1%³. Such results may be due to the improper and infrequent cleaning of the lens cases. Most of the wearer of the study group

claimed that they cleaned their lens cases once a week. Some wearers rinsed their lens case only with tap water, not with disinfectant lens care solution. The use of tap water and lack of air-drying of lens cases contaminate not only the cases but also the lenses, which are stored in them. Thus, it has been suggested that lens cases must be washed with soap and clean water, disinfected with disinfectant solution, wiped with clean tissue paper and then air-dry keeping away from dust.

Table 1: Percentage contamination in different items of contact lens care system & conjunctiva

Items tested	No	Contaminated n (%)
Contact lens cases	100	89 (89)
Contact lenses	100	65 (65)
Daily wear	58	32/58 (55.2)
Extended wear	42	33/42 (78.6)
Conjunctival swabs	100	32 (32)

Table 2: Organisms isolated from contact lens storage cases (Total 89)

Organisms	Frequency n (%)
P. aeruginosa	37 (41.6)
S. epidermidis	25 (28.1)
E. coli	11 (12.4)
Bacillus species	9 (10)
S. aureus	5 (5.6)

Table 3: Organisms isolated from contact lens (Total 65)

Organisms	Frequency n (%)
S. epidermidis	29 (44.6)
P. aeruginosa	23 (35.4)
S. aureus	8 (12.3)
Bacillus species	5 (7.7)

Table 4: Organisms isolated from conjunctiva (Total 32)

Organisms	Frequency n (%)
S. epidermidis	13 (40.6)
P. aeruginosa	10 (31.2)
S. aureus	3 (9.4)
Bacillus species	2 (6.3)

Among the 65 contaminated lenses, more than half were extended wear, while the rest were daily wear. The significantly higher ($P < 0.05$) incidence of contamination of extended wear over daily wear may be due to their higher water content which are likely to pick up debris, including microorganisms which have the potential to cause eye infections⁵. In addition size contamination of lenses, the chronic hypoxic stress due to prolonged contact between the lens and the eye of the wearer can compromise the epithelial barrier against the infections. Such condition serves as an invitation to the potential pathogenic microorganisms^{6,7}.

Before this study, it was reported that P. aeruginosa was the most common contaminant of contact lenses. But as asymptomatic subjects were analyzed during present study S epidermidis was found to be the most frequent contaminant (39.8%), which is also the most common microorganisms in the normal conjunctival flora⁸ i.e. 58%. Nevertheless, conditions may occur during lens wear such as microscopic trauma in the corneal epithelium, reduction in tear volume as well as reduction of aerobic normal epithelial metabolism, may cause the bacterium to become opportunistic and cause infection⁹.

P. aeruginosa was found to be next dominant organisms. It is a Gram-ve rod that is considered as transient microorganisms in the normal healthy eyes. The transient flora is contracted from the environment and inhibits the conjunctiva for hours, days or weeks. Member of transient flora are considered to be of little significance as long as the normal epithelial surface remain intact. It has been implicated in several lens wear complications including keratitis and corneal ulcers. The results of the present study are reflective of the observation that P. aeruginosa and S. epidermidis are the dominant bacteria that cause ocular infections among contact lens wearer. These finding are in confirmation with the earlier reports¹⁰.

S. aureus was isolated from 5.6% of contact lens storage case, 12.3% of contact lenses and 9.4% of conjunctiva. It was reported that 11.8% *S. aureus* was found in contact lens care systems of asymptomatic subjects³. *Bacillus* species was isolated from 10.1% of storage cases, 7.7% of contact lenses and 6.3% of conjunctiva. Few cases of *Bacillus* keratitis among contact lens wearer were reported earlier^{11,12}. As, bacillus spores survived multiple lens disinfection treatments. Above results suggest that contact lens chemical disinfection systems should be capable of killing *Bacillus* species. Otherwise, these organisms remain a threat for contact lens wearer. Other than, *P. aeruginosa* & *Staphylococcus* species, *E. coli* were also frequently found in contact lens storage case, 12.4%. It may be due to lack of personal hygiene and contaminated home water supply¹³.

CONCLUSION

Contact lens wearers are at risk of acquiring microbial keratitis. Extended wear contact lenses are frequently contaminated because of their high water content. Contact lens practitioners should educate contact lens wearer on the risk of sight-threatening microbial keratitis, the need for patient compliance, and prompt assessment of contact lens-related complaints.

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