



“TO STUDY THE PROFILE OF MICROBIAL CONTAMINATION OF CONTACT LENS CASES: A PROSPECTIVE STUDY”.

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ABSTRACT

Background: The advances in contact lens and lens-care solutions, materials and design have contributed to an increase in contact lens wear, for refractive and aesthetic reasons, to about 140 million users worldwide. Contact lens wear has become increasingly popular for vision correction, yet the risk of microbial contamination remains a significant concern.

Aim and Objective: This prospective study aims to investigate the profile of microbial contamination in contact lens cases and identify potential factors contributing to the presence of microorganisms.

Material and Methods: This was a prospective study carried out in the Department of Ophthalmology and Department of Microbiology. One twenty-three contact lens cases and their case age information were collected from asymptomatic contact lens wearers. Cases of the lens were sampled at two locations, the upper rim and the lower base. The samples then underwent for microbiological investigation at Microbiology Department of Major S D Singh Medical College, Farrukhabad.

Results: In the present study out of 123 lens cases, contamination of contact lenses occurred in 56% (69 of 123) of cases. The most frequent micro-organism isolated were Coagulase negative *Staphylococcus aureus* (55.07%), in gram negative *Pseudomonas aeruginosa* (13.04%) and in fungi *Candida* species(7.2%) were isolated. It was also noted that a large number of gram-negative organism recovered from upper rim than the lower rim of flat well lens cases. Lens cases < 3 months of age had lower number of contamination rate than cases aged more than 9 months.

Conclusion: The findings of this research may contribute to the development of effective strategies for minimizing microbial contamination in contact lens cases, ultimately enhancing the safety and well-being of contact lens wearers.

Keywords: Contact lens, Case age, Contamination, Micro-organism, Coagulase negative *staphylococci*.

Introduction

Approximately 125 million people worldwide wear contact lenses[1] for either cosmetic or vision correction purposes. The incidence of contact lens associated complications is rare, but if severe, could lead to permanent vision loss. Microbial keratitis is the most serious and sight threatening condition associated with contact lens wear. Studies have identified risk factors for microbial keratitis[2-5] in an attempt to reduce the disease occurrence. Microbial contamination of contact lens storage cases has been implicated in both microbial and sterile keratitis [2,6,7]. Further, identical strains of bacteria have been isolated from both the corneal ulcer in microbial keratitis and the lens storage case [8].

Bacterial colonization of Contact Lens has also been implicated in Contact Lens-induced inflammation. Specifically, Contact Lens acute red eye (CLARE), Contact Lens peripheral ulcer (CLPU), and infiltrative keratitis have all been associated with adherence of bacteria to hydrogel Contact Lens [9-15].

Contact lens storage case contamination is common even in asymptomatic wearers, occurring in 30 to 80% [16-18] of lens wearers.

Of all the lens care accessories, including the disinfecting solution and contact lens, the lens case was shown to be the most frequently [8,16] and heavily [19] contaminated. Contact lens storage case contamination is thought to be caused by poor hygiene. Yet, even good hygiene compliance does not necessarily guarantee a lens case free of contamination [20]. Other than hygiene factors such as biofilm formation [21] and inherent microbial resistance [22] may be associated with persistent microbial contamination of contact lens storage cases.

Contact lenses are widely used for vision correction, offering convenience and improved aesthetics compared to traditional eyeglasses. However, contact lens wearers face the inherent risk of microbial contamination, which can lead to serious ocular infections.

The presence of the Contact Lens influences development of infection as the lens biomaterial acts as a vector for adherence of microorganisms with subsequent transfer to the ocular surface.

The presence of bacteria, protozoa, and fungi on Contact Lens clearly predispose a patient to the development of infection. In fact, in studies where microbial keratitis was clinically proven, the isolation of organisms from surfaces of the Contact Lens worn during the event was a more sensitive method to detect the causative microorganisms compared with corneal scrapings [23,24].

The contact lens case, being an essential component of lens care, plays a crucial role in preventing contamination. This study aims to provide a comprehensive understanding of the microbial profile in contact lens cases, shedding light on potential risk factors and preventive measures.

Material and Methods

Study site and study design

In this prospective cross-sectional study, a total of 123 used Contact lens cases were collected from asymptomatic lens wearers and the age of the lens cases were also recorded at Major S D Singh Medical College, Farrukhabad for. Processing of samples was done at the Microbiological Department. Those who wears lenses at least once a week for the past four consecutive weeks were included in this study.

Study procedure and laboratory process

Under aseptic circumstances, the cases were opened. Each rim of the lens well, upper and lower, was sampled independently, and any remaining solution in the case was thrown out. The lower inner base of the lens well was rubbed vigorously in a circular motion with a sterile cotton swab and the other sterile cotton swab was used to sample the upper inner rim.

Isolation and identification of Micro-organisms

Sterile cotton swabs were culture onto MacConckey Agar, Blood agar and Chocolate agar then incubate for 24 -48 hours at 37°C while the other sterile swab was used to culture on Sabouroud's Dextrose agar and on HiChrome media for atleast 7 days at room temperature for the identification of fungi and yeast.

After 24 to 48 hrs of incubation culture plates were examined by their morphology and gram's staining. For gram positive cocci, catalase test were performed using 3% hydrogen peroxide and for gram negative bacilli Catalase and oxidase test were performed using oxidase disc.

For identification of fungi SDA were examined for the characteristic culture morphology after 7 days of incubation. Smear were prepared and stained with gram stain for the identification . All the test were done using latest CLSI guidelines [25].

Data Analysis: Descriptive statistics were used to analyse the prevalence and diversity of microbial contaminants.

RESULTS

A total of 123 lens storage cases were examined, in which 28 from the medical college students and 95 from the community wearers. Of the total lens wearers, twenty-one (17%) wore rigid glass permeable(RGP) lens and 102(83%) wore soft contact lens .The disinfecting solutions used were RGP two-step (cleaner and conditioner) , one step hydrogen peroxide, and multipurpose solutions. 60.07% (17 of 28) of lens storage cases belonging to university students and 54.7% (52 of 95) of lens storage cases of

community wearers were contaminated. Contamination rates in contact lens wearers and the types of lens used showed in the Table 1.

Case contamination occurred in 56% (69 of 123) of the total samples. Differences in case types were not statistically significant.

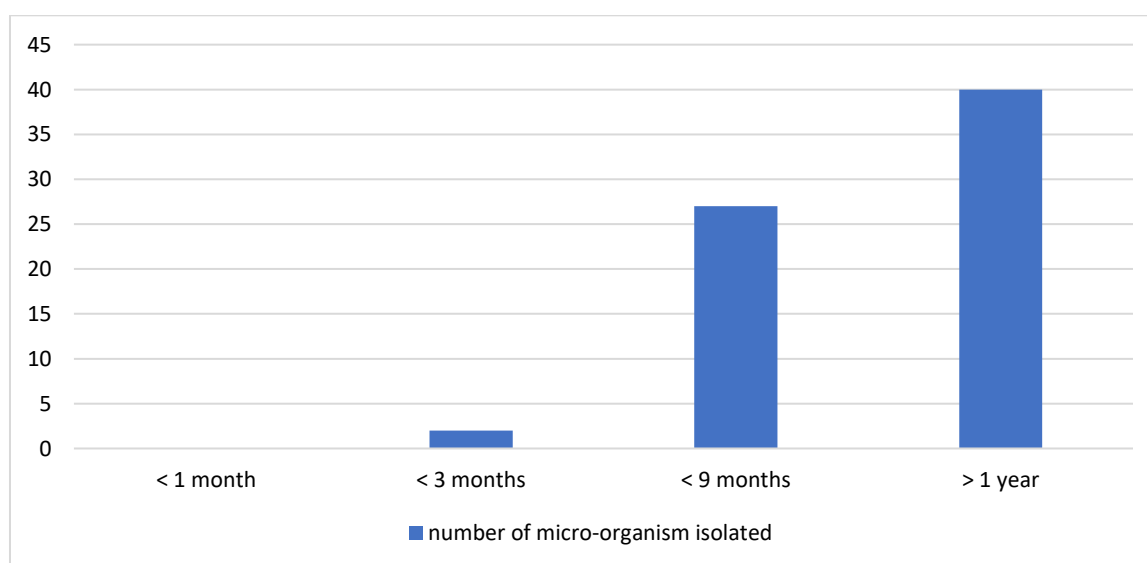
Contact lens wearers	Numbers	Contamination rate (n=69).
Medical College students	28	60% (17)
Community wearers	95	54.7% (52)
Type of contact lens		
RGP lens	21	10.2% (7)
Soft contact lens	102	89.8% (62)
Total	123	69

Table 1: Showing Contamination rates in contact lens wearers and the types of lens used. Among them Medical students and people using Soft Contact lens showing 60% and 89.8% contamination respectively.

Of the 69 contaminated lens cases, the most frequently recovered microorganisms were coagulase-negative *Staphylococci* 55.07% (38 of 69), *Staphylococcus aureus* 20.2% (14 of 69), *Micrococci* 4.5%(3 of 69). Among gram negative bacteria *Pseudomonas aeruginosa* was most common isolated organism 13.04% (9 of 69) and in fungus, *Candida spp* were most frequently isolated 7.2% (5 of 69). Gram negative bacilli were mostly recovered from upper rim while Coagulase negative *Staphylococci*, *Staphylococcus aureus* and *Micrococci* were recovered from the base of the case. Profile and frequency of common isolated microorganisms showed in Table 2.

TYPES OF MICRO-ORGANISM	CULTURE POSITIVITY	PERCENTAGE(%)
Gram-Positive Organism		
<i>Coagulase negative Staphylococci (CONS)</i>	38	55.07%
<i>Staphylococci aureus</i>	14	20.2%
<i>Micrococci</i>	3	4.5%
Gram-Negative Organism		
<i>Pseudomonas aeruginosa</i>	9	13.04%
Fungus		
<i>Candida spp</i>	5	7.2%
TOTAL	69	100%

Table 2: Profile and frequency of common isolated micro-organisms. *Coagulase negative Staphylococci (CONS)*, *Staphylococci aureus* and *Pseudomonas aeruginosa* were most frequently isolated from lens cases.



Graph 1: Showing relationship between Microbial contamination and age of the lens cases. Among them Cases aged more than 9 months showed high level of contamination.

The lens storage case aged less than 3 months showed lesser rate of contamination than the cases aged more than 3 months. Graph 1: Showing relationship between Microbial contamination and age of the lens cases.

DISCUSSION

Contact lenses, especially the soft contact lenses are increasingly being used for cosmetic or therapeutic purposes. Lack of compliance and poor hygiene towards lens care is strongly associated with microbial contamination and has been proved to result in eye infections. Microbial keratitis is one of the serious complications of contact lens use and if not treated timely, may result in permanent visual damage to the cornea. In developed countries, the incidence of contact lens associated keratitis has been increased up to 30 per cent of all keratitis cases [3].

Variations in the sampling location of the lens storage cases, such as examining the top and bottom edges or the areas surrounding the groove and lids, may account for the variance in the contamination level.

In this study, 56% of the total lens storage cases were contaminated, falling within the range of 30 to 80% [9,11,12,26] reported in the literature.

Comparison of the microbial contamination rates between the two sampling locations, in two well cases revealed the number of microorganisms recovered from the upper inner rim was significantly higher than that of the lower inner base, accordance to the study Wu *et al* [27].

The top hinge has occasional contact with un-neutralized hydrogen peroxide, and may therefore be less likely to yield viable microorganisms. Further, the top hinge has limited contact with lens wearers' fingers during lens handling because this is a major source of contamination during lens handling [28,29].

Micrococcus spp. are frequently found in soil, water, dust, or on the skin of man [30] and may be easily introduced into the case while retrieving or depositing contact lenses. Coagulase-negative *Staphylococci* were the most common bacteria isolated from the storage cases [31] and also from contact lenses worn by asymptomatic wearers [32-34] which is similar to this study.

Gram-negative bacteria, which is virulent pathogens, were isolated from some two well lens cases. Gram-negative bacteria were more frequently and sometimes only recovered from the upper inner rim of the lens well, in this study *Pseudomonas aeruginosa* (gram-negative bacteria isolated mostly from the upper rim, which is similar to the study by Wu *et al* [27].

This may be because these bacteria are often strict aerobes, which favour high oxygen environments. Thus, they may accumulate more frequently at the upper inner rim, where a higher concentration of oxygen is available when these lens cases are filled with solution.

The level of lens case contamination was associated with the age of the lens cases. The lens case contamination level was significantly lower in cases that were under 9 months of age. This finding is consistent with the general consensus that lens cases be replaced every 3 to 6 months [35] a study supports that frequent replacement may minimize microbial contamination [36] which is similar to our study in which microbial contamination were higher in lens cases aged more than 9 months.

Commensal or pathogenic organisms can be transferred to the ocular surface via lenses, lens care products, and lens storage cases. To potentially reduce the frequency of microbial adverse outcomes, it is desirable to prevent biofilms and adhering organisms on lens surfaces.

Despite the use of disinfecting solutions, the rate of lens case contamination remains high. As a result, it is best to replace lens storage cases frequently. To determine the effect of various hygiene measures on lowering the microbial load in the lens storage case, more research is necessary.

CONCLUSION

This study aims to contribute valuable data to the understanding of microbial contamination in contact lens cases. The findings may guide the development of targeted interventions and recommendations to enhance the safety of contact lens wearers. Improved knowledge in this area will benefit both practitioners and users in fostering better ocular health among the growing population of contact lens wearers where increased awareness among the users about the lens care practices and regular cleaning and replacements of lens cases and solutions are warranted.

Declarations:

Conflicts of interest: There is no any conflict of interest associated with this study

Consent to participate: We have consent to participate.

Consent for publication: We have consent for the publication of this paper.

Authors' contributions: All the authors equally contributed the work.

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