Microbial Analysis of Contact Lenses

Hemaanhini Tamilmani [a] and N. P. Muralidharan [b*]

*aSaveetha Dental College and Hospital, Saveetha Institute of Medical and Technical Sciences,
Saveetha University, Chennai-600077, India.*
*b Department of Microbiology, Saveetha Dental College and Hospitals, Saveetha Institute of Medical
and Technical Sciences, Saveetha University, Chennai-600077, India.*

Authors' contributions

*This work was carried out in collaboration between both authors. Both authors read and approved the
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ABSTRACT

Introduction: Contact lenses are small, thin lenses which are worn directly on the surface of the eyes. They can be worn aesthetically or to correct vision. Contact lens related eye infections can lead to serious complications such as blindness, and are associated with several risk factors such as sleeping with lenses, exposure to water, not adhering to replacement schedules, and reusing disinfecting solutions, among others. The severity of the infection may vary with the degree of pathogenicity of the microorganism. Hygiene and handling of contact lenses play a very important role. The main aim of this study is to assess the microbial analysis of contact lenses.
Materials and Methods: A total of 15 lenses were collected in 2 ml sterile saline solution individually and manually agitated for five minutes. The lens was then removed using a sterile toothpick from the container. The sterile container was stored at 4°C till it was processed. 50 microliter of the sample was transferred using a pipette and inoculated on nutrient agar, blood agar and sabouraud dextrose agar. The microorganism (fungus or bacteria) were identified by standard protocol.
Results and Discussion: Bacillus, Staphylococcus aureus and CONS [Coagulase Negative Staphylococci] were found in blood agar. No fungal growth was found among the samples. More importance could be given to contact lenses handling and hygiene to avoid eye related bacterial and fungal infections.
Conclusion: In the present study, the total CFU (Colony Forming Unit) was found to be confluent

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*Corresponding author: E-mail: muralidharan@saveetha.com;

in all the participants who wore contact lenses for 4 months compared to those who have worn contact lenses from 15 and 28 days. Only bacterial growth was seen in the culture plate. There was no fungal growth seen from the samples collected.

1. INTRODUCTION

The contact lenses market is ever-growing. Contact lenses are small lenses which are worn directly on the surface of the eyes. They can be worn aesthetically or to correct vision. Few of the advantages of contact lenses are that they have wider field of view, better with asymmetrical prescriptions and for very high prescriptions, cosmetically superior, more practical for sports, avoid weather problems, etc. And few of the disadvantages may be the time required for fitting and adaptation, handling of the patients, wearing time may be limited, lenses can be lost or broken, hygiene maintenance, lens disinfection, problems with foreign bodies, etc [1]. There are two main types of contact lenses; hard and soft contact lenses and there are two types of disposable lenses; daily wear disposable lenses and most extended wear disposable lenses [2]. Each company manufactures lenses that are made from different materials such as hypergel, hydrogel and silicone hydrogel. Hydrogel lenses with silicone hydrogel were found to be used the most up to date, though many other materials were present in it [3]. Contact lens related eye infections can lead to serious complications such as blindness, are associated with several risk factors such as sleeping in lenses, exposure of lenses to water, not adhering to replacement schedules, and reusing disinfecting solutions, etc. Specifically, microbial keratitis is an ocular infectious disease affecting the cornea and pathogenetically resulting from microorganisms which may potentially cause ocular disability [4].

The severity of the infection may vary with the degree of pathogenicity of the microorganism. Microbial keratitis associated with wearing contact lenses still remains a serious concern for patients and the contact lens industry [5]. Acanthamoeba is a ubiquitous pathogen which is found worldwide. Acanthamoeba keratitis could potentially cause blinding corneal infection and aggressively infect both the eyes. Contact lens related problems depend on lens material, lens hygiene, wearing procedure, degree of compliance of the lens wearer with contact lenses and related procedures, type of lens caring solution, etc. Basic hygiene if followed by contact lenses wearers can reduce the rate of eye infections [6].

In one of the previous studies, it was seen that the most frequent behaviour of contact lens wearers was sleeping with contact lenses. And also few of the contact lens wearers do not follow the recommended replacement schedules leading to eye discomfort and other complications [7]. Strong association was found between the bacterial contamination on lens surfaces and the bacterial contamination on eyelids and conjunctiva. This can be due to the disruption of the normal microbiota of the eye due to the prolonged use of contact lenses. This may lead to various eye infections and other complications. The underlying mechanism of how contact lenses wear affects the normal microbiota of the eye is still unknown [8]. Our team has extensive knowledge and research experience that has translate into high quality publications [9–13].

A previous study done by Sarah. A. Collier et al, an online survey was prepared and distributed among 4,548 adults and 1618 adolescents. Both groups were subjected to lower compliance with contact lens hygiene which can result in a greater risk of corneal inflammation and serious eye infection [14–30]. Young adults were found more likely to replace their contact lenses at regular schedules compared to adolescents. This might be due to daily lifestyle behaviour. The authors stated that awareness and prevention efforts and knowledge on contact lens related infection can be spread through improving communication strategies for a healthier contact lens behavior [31]. Hygiene and handling of contact lenses play a very important role. More knowledge and awareness on various eye infections resulting from poor hygiene and handling must be spread. The main aim of this study is to assess the microbial analysis of contact lenses.

2. MATERIALS AND METHODS

A total of 15 lenses (collected from female participants belonging to age below 20 years) were collected in 2 ml sterile saline solution individually (varying in power and material type) and manually agitated for five minutes. The lens was then removed using a sterile toothpick from the container. The sterile container was stored at 4°C till it was processed. 50 microliter was pipetted and inoculated on nutrient agar, blood agar and sabouraud dextrose agar. Nutrient and blood agar was divided into two halves and 2 samples were inoculated and kept at 37° Celsius for 24 hours. Also sabouraud dextrose agar was divided into two halves and 2 samples were inoculated and kept at 37° Celsius for 24 hours and then at room temperature for 24 hours. The microorganism (fungus or bacteria) were identified by standard protocol.

3. RESULTS

Bacillus, Staphylococcus aureus and CONS [Coagulase Negative Staphylococci] was found in blood agar (Fig. 01) (Fig. 02). No fungal growth was found among the samples (Fig. 03). The mean value of the total CFU (Colony Forming Unit) for the samples used for 15 days were found to be 430.6 (Table 01), 504.6 for 28 days (Table 02) and 680.2 for 4 months (Table 03).

Fig. 1. Sample inoculated on blood agar
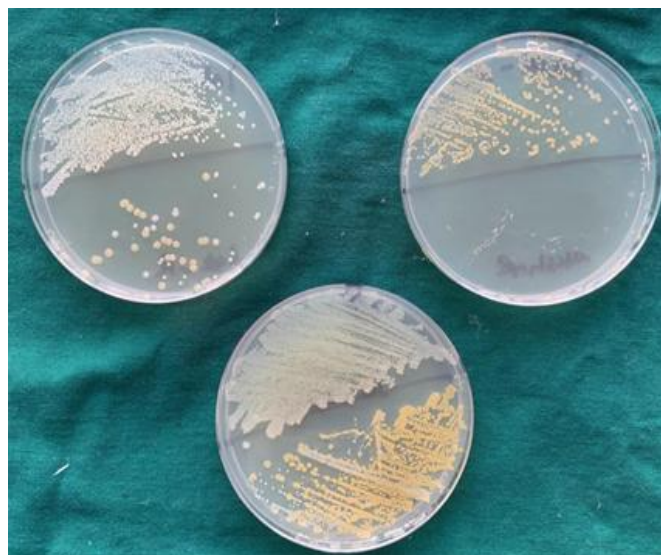
Fig. 2. Sample inoculated on nutrient agar
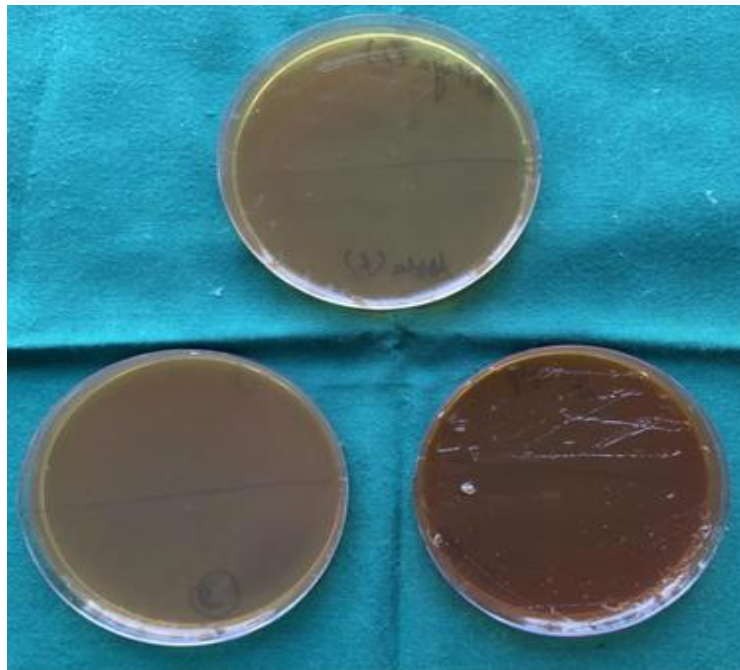
Fig. 3. Sample inoculated on sabouraud dextrose agar

Table 1. Table depicts total CFU (Colony Forming Unit) obtained from the contact lenses in relation to 15 days of usage and the total mean value

Samples	No. Of days contact lens worn	Bacteria count
1	15 days	313
2	15 days	412
3	15 days	561
4	15 days	411
5	15 days	456
		Mean= 430.6

Table 2. Table depicts total CFU (Colony Forming Unit) obtained from the contact lenses in relation to 28 days of usage and the total mean value

Samples	No. Of days contact lens worn	Bacteria count
6	28 days	703
7	28 days	590
8	28 days	442
9	28 days	367
10	28 days	421
		Mean= 504.6

Table 3. Table depicts total CFU (colony forming unit) obtained from the contact lenses in relation to 4 months of usage and the total mean value

Samples	No. Of days contact lens worn	Bacteria count
11	4 months	Confluent (>1500)
12	4 months	449
13	4 months	487
14	4 months	441
15	4 months	524
		Mean= 680.2

4. DISCUSSION

The main objective of this study was to find the difference in the amount of microorganisms there could be present in different contact lens wearers. In the present study, it was noticed that those who change their lenses once in a month were less prone to suffer bacterial infection of the eye than those who change their lenses once in a month. Bacillus, Staphylococcus aureus and CONS [Coagulase Negative Staphylococci] was found in blood agar (Fig. 01) (Fig. 02). No fungal growth was found among the samples (Fig. 03). The mean value of the total CFU (Colony Forming Unit) for the samples used for 15 days were found to be 430.6 (Table 01), 504.6 for 28 days (Table 02) and 680.2 for 4 months (Table 03). Wearing contact lenses is a well-known risk factor for the development of microbial keratitis and other inflammatory eye conditions. In another research article by Maya M Rao et al, it was found that the most frequent behaviour of contact lenses was that the participants slept with contact lenses. Though the precise mechanism of eye infection is unknown, prolonged lens replacement schedules, non-compliance to recommended lenses can lead to eye infections.

Daily disposable contact lens wearers were less prone to eye infections related to contact lenses [32][33]. Showering while wearing contact lenses, swimming while wearing contact lenses without goggles, should be avoided as associated with sight threatening infections were found. Contact lens hygiene was noticed as a compulsory and a very important factor in public health [34]. According to Wu Yvonne T et al, the major factors for reducing contact lens contaminants are washing hands with soap and water before use, air drying lens case and matching disinfection solution with lens cases [35]. And in another article written by Vinicius Targa Villas Boâs et al, it was found that no fungal growth was found in the lenses but bacterial growth was found in 39 cases out of 70 lens cases. Many variables were present in the study not allowing the exact type of bacteria to be identified. But more than 85% of the bacteria were gram- negative bacilli [36].

Bailey CS had stated in their article that polymethyl-methacrylate (PMMA) lenses were 9 times less likely to be associated with extended wear soft lenses. And also extended wear soft lenses were 5 times more prone to be linked with microbial keratitis than daily wear soft lenses [37]. Despite the increased use of daily disposable contact lenses, bacterial ulcer incidence is on the rise. Sleeping with contact lenses was one of the main risk factors in contact lens related infections. Acanthamoeba and fungal infections related to contact lenses are also on the rise which could lead to severe vision and blinding threats [38]. More importance could be given to contact lenses handling and hygiene to avoid eye related bacterial and fungal infections. In the present study, all the participants had stated that they had no eye infection. Regarding washing their hands before touching lenses, they stated they wash their hands everyday but in certain circumstances they tend to forget to wash their hands. Few of the limitations seen in the present study was that the sample size was small and samples from all age groups could have been collected. These limitations can be considered for future studies.

5. CONCLUSION

In the present study, the mean CFU (Colony Forming Unit) was found to be confluent in the participants who wore contact lenses for 4 months compared to those who wore contact lenses from 15 and 28 days. Only bacterial growth was seen in the culture plate. There was no fungal growth seen from the samples collected. In future studies, the limitations seen in the present study could be considered for better results and understanding.

CONSENT AND ETHICAL APPROVAL

As per international standard or university standard guideline participant consent and ethical approval has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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