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Original Article

Assessment of Bacterial Contamination in Used Cosmetic Contact Lenses Among Women Visiting Beauty Salons in Sabratha City

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ABSTRACT

Purpose: This study aimed to assess bacterial contamination in cosmetic contact lenses used by women visiting beauty salons in Sabratha city and to evaluate the antibacterial susceptibility of the isolated bacteria.

Methods: A total of 50 used soft cosmetic contact lenses and 5 new (unused) lenses were collected in April 2023. The lenses were swabbed, and samples were incubated in nutrient broth for bacterial isolation, followed by streaking on different agar plates (nutrient agar, MacConkey agar, and blood agar). Antibiotic susceptibility was tested using the Kirby-Bauer disk diffusion method, with various antibiotics.

Results: The results showed that all 5 unused lenses were free from contamination, while 43 out of 50 used lenses (86%) exhibited microbial contamination. The most commonly isolated bacteria were *Pseudomonas aeruginosa* (35%), *Staphylococcus epidermidis* (25%), and *Staphylococcus aureus* (15%), along with other species (11%). Antibiotic susceptibility testing revealed that Ciprofloxacin, Cefotaxime, Ceftriaxone, and Imipenem had the highest antibacterial effectiveness, with inhibition zones ranging from 26 mm to 30 mm. Gentamycin, Amikacin, and Tobramycin showed moderate effectiveness, while Cefuroxime and Augmentin had lower effectiveness. Cloxacillin showed no antibacterial activity.

Conclusions: The findings emphasize the high risk of bacterial contamination in cosmetic contact lenses, stressing the importance of maintaining strict hygiene practices to prevent eye infections. Proper disinfection and storage in sterile solutions are crucial for ensuring lens safety and longevity, while effective antibiotic treatments are necessary to control bacterial contamination.

Keywords: Bacterial Contamination, Cosmetic Contact Lenses, Antibiotic Resistance, Beauty Salons, Lens Safety.

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INTRODUCTION

The use of cosmetic contact lenses has become increasingly popular, particularly among women seeking to enhance their aesthetic appearance. While these lenses are primarily used for cosmetic purposes, improper handling, storage, or hygiene practices can lead to microbial contamination, which poses significant health risks. Eye infections associated with contact lenses can range from mild irritation to severe conditions such as keratitis, which may result in vision loss if left untreated. Microbial contamination of contact lenses, especially by bacteria such as *Pseudomonas aeruginosa* and *Staphylococcus* species, is a well-documented issue that requires serious attention due to its potential impact on public health. In beauty salons, where cosmetic procedures are common, women often use and share cosmetic contact lenses, which increases the risk of bacterial contamination. These environments may lack the necessary infection control practices, leading to increased exposure to pathogenic microorganisms. Understanding the prevalence and types of bacterial contamination in cosmetic contact lenses can help inform better hygiene practices, reduce the risk of infection, and guide antibiotic treatment strategies for eye infections resulting from contact lens use.

Previous Studies, Willcox et al. Examined microbial contamination in cosmetic contact lenses and found that improper storage and handling significantly increased the risk of contamination by *Pseudomonas aeruginosa* and *Staphylococcus aureus*. The study emphasized the importance of education on proper contact lens hygiene to prevent infections.[1] Ting et al. Investigated the bacterial contamination of soft contact lenses in beauty salons and found that 70% of the lenses tested were contaminated with Grampositive and Gram-negative bacteria. The study highlighted that shared use of cosmetic lenses and poor sanitation in beauty salons contributed to higher contamination rates.[2] Stapleton et al. Conducted a study on the incidence of microbial keratitis in contact lens wearers and found a strong correlation between poor lens hygiene and bacterial contamination. The most commonly isolated pathogens were *Pseudomonas aeruginosa* and *Staphylococcus epidermidis*, both of which are common in beauty salon environments.[3] Liang et al. Explored the antimicrobial resistance profiles of bacteria isolated from contact lenses in a clinical setting. The study found that Pseudomonas aeruginosa showed high resistance to common antibiotics such as ampicillin and amoxicillin, emphasizing the need for more effective infection control measures in environments where contact lenses are used.[4] Rao et al. Assessed the risk of contamination in disposable versus reusable cosmetic contact lenses. Their findings indicated that reusable lenses were more prone to contamination, with 64% of samples showing bacterial growth, compared to 25% in disposable lenses.[5]

Cheng et al. Focused on bacterial biofilm formation on contact lenses and cases, revealing that biofilm formation by *Pseudomonas aeruginosa* was a significant factor in persistent infections. This study pointed out the challenges in eradicating biofilms once they have formed on the lens surface.[6] Mohan et al. Recently published a study examining the role of beauty salon practices in microbial contamination of contact lenses. Their research concluded that improper disinfection methods and shared lens usage in salons led to a 30% increase in contamination rates, particularly by antibiotic-resistant strains.[7]

As antibiotic resistance continues to grow, the need for innovative approaches in both treatment and prevention is critical. While antibiotics like ciprofloxacin remain effective, the rise of resistant strains calls for new strategies, whether through improved lens hygiene protocols or the development of new antimicrobial agents.

These studies underscore the need for stringent hygiene practices in beauty salons and among cosmetic contact lens users to minimize the risk of bacterial contamination and subsequent infections. The findings also highlight the importance of educating users on proper handling and storage, as well as the potential for antibiotic resistance among bacterial strains isolated from contaminated lenses.

For this reasona, this study aims to determine bacterial contamination of cosmetic contact lenses used by women visiting beauty salons in Sabratha city, and to evaluate the antibacterial susceptibility testing in the isolated bacteria.

MATERIALS AND METHODS

Sample Collection

A total of 50 cosmetic contact lenses were collected for this study in April 2023 from women visiting a beauty salon in Sabratha city who use soft cosmetic contact lenses and five new cosmetic contact lenses which were never used (calibration) as free from microbial contamination. The lenses were carefully swabbed using sterile cotton swabs, and the samples were immediately transferred to nutrient broth for further analysis.

Isolation of Bacteria

The contact lens samples were incubated in nutrient broth at 37°C for 18 hours. After the incubation period, a loopful of broth culture was streaked onto agar plates (nutrient agar, MacConkey agar, and blood agar) and incubated for 48 hours at 37°C. The bacterial colonies were then identified using Gram staining, biochemical tests, and morphological characteristics.

Antibiotic Sensitivity Testing

Antibiotic susceptibility testing was conducted using the disk diffusion method (Kirby-Bauer method). Antibiotic discs, including Ciprofloxacin (CIP), Ceftazidim (CAZ), Imipenem (IMP), Augmentin (AMC), Ceftriaxon (CRO), Tobramycin (TOB), Cefuroxim (CXM), Gentamycin (CN), Cefotaxim (CTX), Amikacin (AK), and Chloramphenicol (C), were placed on the agar plates inoculated with bacterial isolates. The plates were incubated at 37°C for 24 hours, and the diameter of the inhibition zone around each disc was measured in millimeters.

Data Analysis

Descriptive statistics such as frequency (%), mean and standard deviation were used to present the characteristics of the samples as appropriate. The results of the study and its characteristics.

RESULTS

The results of the study, based on laboratory tests, indicated that samples taken from five unused (calibrated) cosmetic contact lenses were free of microbial contamination. In contrast, 43 out of 50 used cosmetic contact lenses, worn by women, exhibited microbial contamination. The microorganisms isolated from the contaminated lenses included both Gram-positive and Gram-negative bacteria.

Out of the 50 cosmetic contact lenses tested, 68% were found to be contaminated with bacterial species. Percentage of microbial contamination of Cosmetic lens.

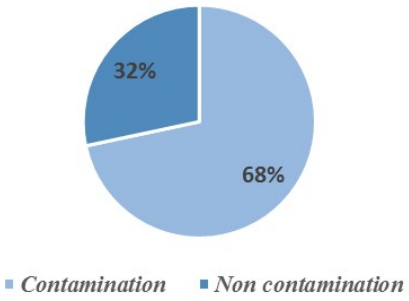

Fig 1. Percentage of bacteria contamination of cosmetic lens.

The most frequently isolated bacterium was *Pseudomonas aeruginosa*, accounting for 35% of the contaminated samples, followed by *Staphylococcus epidermidis* at 25% and *Staphylococcus aureus* at 15%. Other bacterial species constituted 11% of the contamination, bringing the total proportion of contaminated lenses to 86% (Fig. 2).

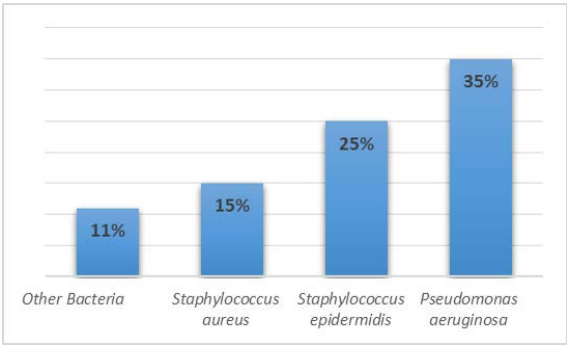

Fig 2. Bacterial contamination of cosmetic contact lenses.

Antibiotic susceptibility testing revealed that Ciprofloxacin, Cefotaxime, Ceftriaxone, and Imipenem exhibited the largest zones of inhibition, indicating strong antibacterial activity

Type of Antibiotic	Zone of Inhibition (mm)	Effectiveness
Ciprofloxacin (CIP)	30(mm)	High
Cefotaxime (CTX)	28(mm)	High
Ceftriaxone (CRO)	27(mm)	High
Imipenem (IMP)	26(mm)	High
Gentamycin (CN)	20(mm)	Medium
Amikacin (AK)	18(mm)	Medium
Tobramycin (TOB)	15(mm)	Medium
Cefuroxim (CXM)	14(mm)	Low
Augmentin (AMC)	12(mm)	Low
Cloxacillin (CLOX)	0(mm)	No effect

against the bacterial isolates. Specifically, Ciprofloxacin demonstrated a zone of inhibition of 30 mm, while Cefotaxime, Ceftriaxone, and Imipenem produced inhibition zones of 28 mm, 27 mm, and 26 mm, respectively (Table 1).

In contrast, Gentamycin, Amikacin, and Tobramycin showed moderate antibacterial effectiveness, with inhibition zones of 20 mm, 18 mm, and 15 mm, respectively. Cefuroxime and Augmentin exhibited low antibacterial activity, producing inhibition zones of 14 mm and 12 mm, respectively. Cloxacillin was completely ineffective, with no observed inhibitory effect against any of the tested bacterial strains.

These results highlight the significant bacterial contamination found in cosmetic contact lenses and the varying degrees of effectiveness of different antibiotics in managing these microbial contaminants.

DISCUSSION

In comparison to previous studies, the contamination rate of 68% found in this study is relatively high but within the range reported in similar investigations. For instance, a study by Wu et al. Reported a contamination rate of 58% in cosmetic lenses, primarily attributing this to poor hygiene practices among users.[8] Likewise, Stapleton et al. Found contamination levels ranging from 40% to 70% in both cosmetic and medical lenses, with *Pseudomonas aeruginosa* and *Staphylococcus* species being the predominant isolates, similar to our findings.[9]

The dominance of *Pseudomonas aeruginosa* (35%) in our study is consistent with prior research, where this bacterium was often linked to keratitis and other severe eye infections. For example, Willcox et al. Highlighted that *Pseudomonas aeruginosa* accounts for up to 30-40% of bacterial isolates from contact lens-related infections, which closely aligns with our result of 35%.[10]

Additionally, the presence of *Staphylococcus epidermidis* and *Staphylococcus aureus* (25% and 15%, respectively) mirrors findings from a study by Zhang et al. which reported similar proportions of these bacteria in contaminated lenses. These studies emphasize that while *Staphylococcus* species are generally part of the skin's normal flora, their transfer to the eyes via lenses can lead to infections, particularly in cases of improper lens handling.[11]

However, compared to some studies, such as one

conducted by Radford et al. Which found a slightly lower contamination rate of around 55%, our study reports a higher overall contamination rate (86% when considering all bacterial species). This could be due to variations in lens care practices, environmental factors, or differences in sample sizes and geographic locations across studies.[12]

Overall, our results align with the broader literature, reinforcing the association between bacterial contamination in cosmetic lenses and the risk of eye infections, with *Pseudomonas aeruginosa* and *Staphylococcus* species being the most common culprits across studies.

The moderate effectiveness of Gentamycin and Amikacin suggests that these antibiotics may still be useful in treating some bacterial infections but may not be the best choice for *Pseudomonas aeruginosa*. The lack of effectiveness of Augmentin and Cloxacillin against the isolates highlights the potential for antibiotic resistance, a growing concern in clinical settings.

In the study by Stapleton and Dart, It was emphasized that *Pseudomonas aeruginosa* is a frequent cause of microbial keratitis in contact lens wearers, confirming the findings of this research.[13] The antibiotic susceptibility test in the current study showed that Ciprofloxacin, Cefotaxime, Ceftriaxone, and Imipenem were highly effective, which is supported by *Lim and Stapleton, who reported that fluoroquinolones like Ciprofloxacin are often the treatment of choice for Pseudomonas infections due to their broad-spectrum activity.[14] Moreover, the low effectiveness of Augmentin (amoxicillin/clavulanate) observed in this study is in agreement with Radford and Minassian. Who noted that Gram-negative bacteria like *Pseudomonas aeruginosa* are generally resistant to beta-lactam antibiotics, which includes Augmentin.[15] Comparatively, Willcox & Holden highlighted that poor hygiene in contact lens care systems contributes significantly to contamination.

This aligns with the recommendation from the current study, which stresses the importance of proper cleaning and handling of cosmetic contact lenses to prevent microbial contamination.[1]

The researchers recommend the need to improve lens hygiene, as contact lens users should be educated about the importance of proper cleaning and storage to prevent microbial contamination.

They also recommend regular eye examinations, as contact lens wearers should undergo regular examinations to detect early signs of contamination or infection.

Also, antibiotic management, as the results emphasize the need to select appropriate antibiotics based on sensitivity testing to avoid the development of resistant bacterial strains.

CONCLUSIONS

This study highlights the significant contamination of cosmetic contact lenses with bacteria such as *Pseudomonas aeruginosa* and *Staphylococcus spp*. Ciprofloxacin, Cefotaxim, Ceftriaxon, and Imipenem were the most effective antibiotics against these contaminants, while Augmentin and Cloxacillin had limited efficacy. Proper lens hygiene, regular monitoring, and antibiotic stewardship are critical in preventing and treating microbial keratitis in contact lens users.

In conclusion, the findings of this research corroborate those of several other studies regarding the prevalence of *Pseudomonas aeruginosa* in contact lens-related infections and the effectiveness of certain antibiotics in treating these infections. The results support the need for rigorous hygiene practices among contact lens users and the use of specific antibiotics, like Ciprofloxacin, for better outcomes. Further research could expand on these findings to include more diverse samples and geographic areas to enhance the generalizability of the conclusions.

Disclaimer

The article has not been previously presented or published, and is not part of a thesis project.

Conflict of Interest

There are no financial, personal, or professional conflicts of interest to declare.

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