

Microbial Contamination of Contact Lenses After Tooth Preparation in Fpd Cases Using Airotor with or Without Protective Face Shield

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Running title : Microbial contamination of contact lenses after tooth preparation in FPD cases using airotor

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STRUCTURED ABSTRACT

BACKGROUND : Aerosol and splatter are a concern in dental specialty attributable to their potential effects on the health of patients. Microbial contamination of contact lenses during extended wear (EW) is of major concern to practitioners because contact lenses worn for extended periods of time are believed to be potential reservoirs of pathogenic bacteria.

AIM : The purpose of the present study was to evaluate aerosol contamination of contact lenses of the dentist after teeth preparation in fixed rehabilitation cases using arotor, microbial count on contact lenses of the dentist, to determine the effectiveness of protective face-shield.

MATERIALS AND METHODS : Thirty subjects from the outpatient section in the Department of Prosthodontics, Saveetha Dental College, Chennai who had come for a Fixed rehabilitation therapy were enrolled in this study. The clinicians were randomly distributed into 3 groups, Group 1: Clinicians using only contact lenses, Group 2: Clinicians using contact lenses and Faceshield, Group 3: Clinicians using only Face Shield. Muller Hinton Agar (MHA) agar was utilized for this activity to determine the zone of inhibition. The statistical analysis one way ANOVA was performed using commercially available software (SPSS version 10.5, IBM, Chicago, IL, USA).

RESULTS : Tables and graphs were generated using Microsoft Word and Excel. Overall, the results of this study indicate low microbial contamination of contact lens in Group C (protectiveFaceshield) followed by Group B (contact lens without protective eyewear) which is statistically significant ($P < 0.01$).

CONCLUSION : Concluding from the results of this study, dental practitioners should avoid contact lenses as the risk of contamination from aerosols. In circumstances where contact lenses are used, it is recommended to wear protective Face Shield/Eyewear.

KEYWORDS: Aerosol, Contact lens, COVID-19, Microbial contamination, protective eyewear

INTRODUCTION

Aerosol and splatter are a concern in medical and dental specialty attributable to their potential effects on the health of patients whose immunity is compromised and of dental personnel. There's constant concern that aerosols from dental procedures could also be regulated by the Activity Safety and Health Administration, or OSHA, as a part of standards for indoor air quality. Many routine dental procedures produce aerosol and splatter composed of various combinations of water; organic particles, such as tissue and tooth dust; and organic fluids, such as blood and saliva. Many reports in the literature demonstrate increases in the number of airborne bacteria during various aerosol-producing dental procedures^{1, 2-4}.

Aerosol from ultrasonic or arotor instrumentation always contains blood and lingers in the air for 30 min or longer in the entire operation and areas of the dental office outside the operator^{5,6}. Pneumococci, staphylococci, alpha hemolytic, streptococci, and *Mycobacterium tuberculosis* are among the bacteria that have been found in dental aerosols. The microorganisms which have been isolated in dental aerosols (American Academy of Periodontology classification) are associated with various diseases such as staphylococcal.

Microbial contamination of contact lenses during extended wear (EW) is of major concern to practitioners who fit lenses and advise wearers on contact lens maintenance because contact lenses worn for extended periods of time are believed to

be potential reservoirs of pathogenic bacteria. The contact lens wearers are at great risk of developing ocular infections because of incorrect usages and unhygienic maintenance of contact lenses. Various bacteria have been associated with adverse corneal events such as microbial keratitis⁷, contact lens-induced acute red eye (CLARE)^{8,9} and contact lens-induced peripheral ulcers (CLPU; previously termed culture-negative peripheral ulcers)^{10,11}. Gram-negative bacteria, particularly *Pseudomonas aeruginosa* and *Haemophilus influenzae*, are associated with microbial keratitis and CLARE,⁸ respectively, and Gram-positive bacteria such as *Staphylococcus aureus* and *Streptococcus pneumoniae* are associated with CLPU^{10,12}.

Concerns about microbial contamination of contact lenses and the adverse responses associated with its use have been expressed since their inception. However, there are no reported cases or studies of microbial contamination of contact lenses after dental treatment procedures such as scaling and root planing with ultrasonic scalers which produce aerosol or splatter.

Studies till date show that dental handpieces, air-water syringes, air-polishing units and ultrasonic scalers produce a many-fold increase in the number of colony-forming units, or CFUs, cultivable from the air compared with preprocedural levels¹³. They showed that a sneeze and the use of the air turbine handpiece produced comparable aerosols and splatter and a four-fold increase of airborne bacteria has been observed in areas where aerosol producing equipment was used.

The purpose of the present study was to evaluate aerosol contamination of contact lenses of the dentist after teeth preparation in FPD/ FMR cases using arotor, qualitative analysis of microorganisms on contact lenses of the dentist, to determine the effectiveness of protective face-shield.

MATERIALS AND METHODS

The participants for this study were selected from the outpatient section in the Department of Prosthodontics, Saveetha Dental College, Chennai. Thirty subjects (ten males, twenty females aged between 35 and 50 years) who had come for a Fixed rehabilitation therapy were enrolled in this study. The study protocol was approved by the ethical committee of the institution and informed consent was obtained from the participants.

Inclusion criteria:

- Subjects aged between 35 and 50 years who wanted FDP/Full mouth rehabilitation therapy
- Moderate to severe chronic periodontitis (as per the American Academy of Periodontology classification)
- Minimum of twenty teeth present
- No history of periodontal or antibiotic therapy in the preceding 6 months
- dentists who wear contact lenses without any history of eye infection in the last 6 months.

Exclusion criteria:

- Subjects with definite contraindications for the use of arotor, for example, patients with known communicable diseases that can be transmitted by aerosols
- Subjects with a cardiac pacemaker
- Subjects with respiratory diseases such as chronic pulmonary disorders
- Immunocompromised subjects

- Subjects with titanium implants, which can be etched or gouged
- Pregnant or lactating mothers.

The clinicians were randomly distributed into 3 groups, Group 1: Clinicians using only contact lenses, Group 2: Clinicians using contact lenses and Faceshield, Group 3: Clinicians using only Face Shield.

Antibacterial Activity

Muller Hinton Agar (MHA) agar was utilized for this activity to determine the zone of inhibition. Muller Hinton Agar was prepared and sterilized for 45 minutes at 120lbs (Fig 1). Media poured into the sterilized plates and let them stabilize for solidification (Fig 2). The test samples were swabbed and collected in a sterile container (Fig 4). The different concentrations were loaded and the plates were incubated for 24 hours at 37 ° C. After the incubation time the zone of inhibition was measured.



Figure 1: Figure showing the Sterile Container, Aquacolor Lenses and Sterile Water Vials

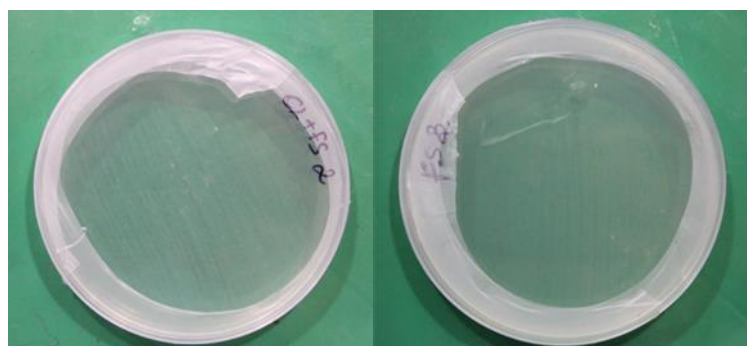


Figure 2: Figure showing the Inoculation Of Swabbed Contaminated Sample Onto Agar Plates

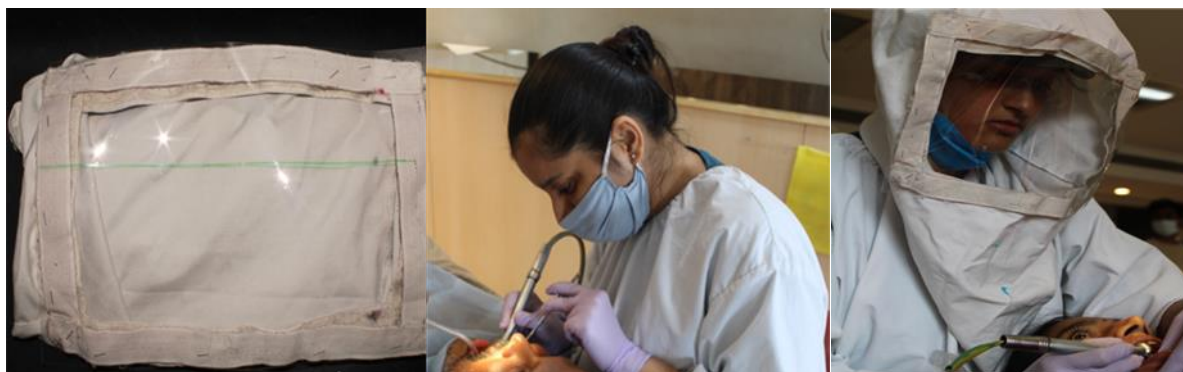


Figure 3: Figure showing the :

a:marked area of face shield analysed and

B:Clinicians Doing Teeth Preparation with contact lenses

c:Clinicians doing teeth preparation with contact lenses and faceshield



Figure 4: Figure showing the Sample Collection After Use Of Airotor Procedures

Statistical analysis

Power analysis calculations were performed before the study was initiated. The statistical analysis was performed using commercially available software (SPSS version 10.5, IBM, Chicago, IL, USA). Tables and graphs were generated using Microsoft Word and Excel. Contingency coefficient test was used for intergroup comparisons [Figure 1]. It gives the association between the groups and the responses. Statistical significance was defined as $P < 0.01$, which is highly significant.

RESULTS

All the samples were cultured on infusion broth and incubated in aerobic and anaerobic conditions for 24–48 h at 37°C (Figure 5).

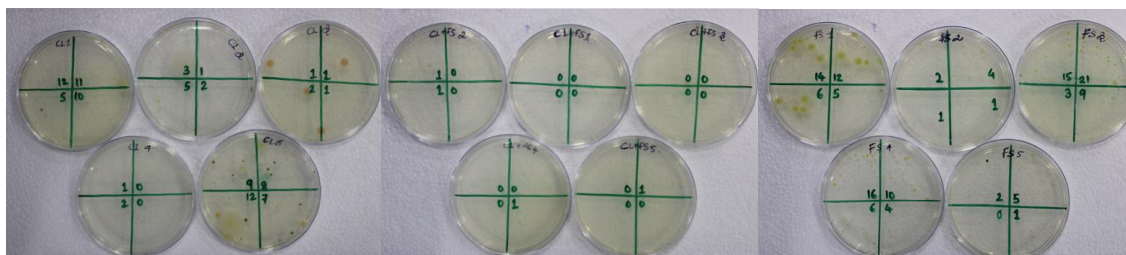


Figure 5: Figure showing the samples inoculated in agar plates

a: contact lenses only, b:contact lens+face shield, c:face shield

After 48 h of incubation, in Group A (contact lens only) Group B (Contact lens + protective Face Shield) - 10 out of thirty samples and in Group C (Protective Face shield) - all the thirty samples were collected and tabulated (Table 1). A total of thirty samples were analyzed.

TABLE 1: Table showing the overall microbial count of samples in various groups

GRO UP	GROUP NAME	SAMPLES	MICROBIAL COUNT
A	CONTACT LENS ONLY	<ul style="list-style-type: none"> ● CL1 ● CL2 ● CL3 ● CL4 ● CL5 ● CL6 ● CL7 ● CL8 ● CL9 ● CL10 	<p>38</p> <p>11</p> <p>5</p> <p>3</p> <p>36</p> <p>21</p> <p>31</p> <p>18</p> <p>14</p> <p>28</p>
B	CONTACT LENS + FACE SHIELD	<ul style="list-style-type: none"> ● CL+FS - 1 ● CL+FS - 2 ● CL+FS - 3 ● CL+FS - 4 ● CL+FS - 5 ● CL+FS - 6 ● CL+FS - 7 ● CL+FS - 8 ● CL+FS - 9 ● CL+FS - 10 	<p>2</p> <p>0</p> <p>0</p> <p>1</p> <p>1</p> <p>5</p> <p>2</p> <p>3</p> <p>1</p> <p>2</p>
C	FACE SHIELD ONLY	<ul style="list-style-type: none"> ● FS - 1 ● FS - 2 ● FS - 3 ● FS - 4 ● FS - 5 ● FS - 6 	<p>36</p> <p>8</p> <p>48</p> <p>36</p> <p>8</p> <p>12</p>

		<ul style="list-style-type: none"> ● FS -7 ● FS -8 ● FS -9 ● FS -10 	<p>28</p> <p>31</p> <p>34</p> <p>40</p>
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Overall, the results of this study indicate low microbial contamination of contact lens in Group C (protectiveFaceshield) followed by Group B (contact lens without protective eyewear) which is statistically significant ($P < 0.01$) (Figure 6).

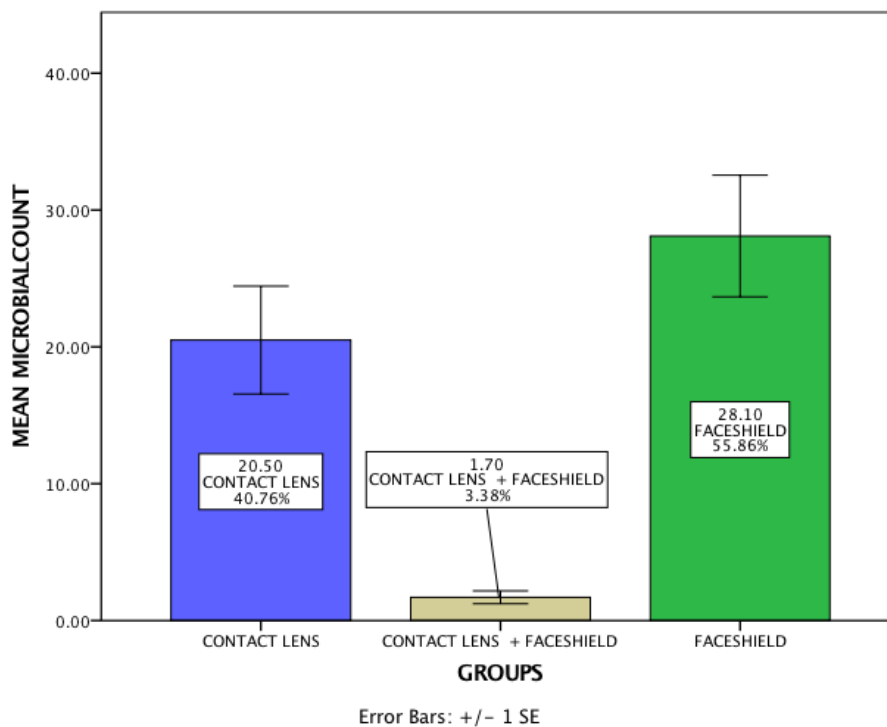


Figure 6: Bar graph depicting the low microbial contamination of contact lens in Group C (protectiveFaceshield) followed by Group B (contact lens without protective eyewear) which is statistically significant ($P < 0.01$)

DISCUSSION

Overall, the results of this study indicate low microbial contamination of contact lens in Group C (protective Face shield) followed by Group B (contact lens without protective eyewear) which is statistically significant ($P < 0.01$) (Figure 6). In this study, we found that a considerable amount of bacterial and fungal contamination was seen with the use of contact lenses by clinicians with differences in the amount of contamination with the use of protective face shields. However, even after wearing protective eyewear, there is contamination of the contact lens which can be very hazardous to the eyes.

Till date, various studies have confirmed that an aerosolized bacterial contamination is produced during the use of ultrasonic scalers and other dental equipment that produce an aerosol spray¹⁴⁻¹⁷. Few studies have also demonstrated that dental operations involving air and water sprays in combination with rotating instruments may cause levels of contamination exceeding those produced by common oral activities^{18,19}. A potential bacterial challenge exists in the aerosol produced by ultrasonic scalers which is peaking at over 300 CFU/cu ft of dental operative volume¹⁶.

There is an increased concern about aerosol contamination and decreased air quality in the dental office. According to the Center for Disease Control Guidelines for Infection Control in Dental Health-Care Settings (2003), preventive measures

to control dental office air contamination include universal precautions. Protective measures recommended to reduce the risk of infection from aerosols may be classified as physical, chemical, and personal safeguards. People choose to wear contact lenses for many reasons such as visual, esthetics, and cosmetics which are often motivating factors for people who would like to avoid wearing glasses or change the appearance of their eyes.

The unique structure of the human eye, the use of contact lenses and the constant exposure of the eye directly to the environment renders it vulnerable to a number of uncommon infectious diseases caused by microorganisms. Contact lenses do not protect the eyes and can increase the risk of exposure to microorganisms if contaminated fluids gain access beneath the lens^{20,21}. Eyes are particularly vulnerable to injury by high-velocity particles/debris generated during use of high-speed handpieces and ultrasonic scalers. It has been reported that the environment, the type of contact lens, the duration of wear, and the type of contact lens cleansing solution determined the microbial load on the contact lenses. The normal ocular microbiota in the absence of contact lens wear is composed almost exclusively of bacterial types such as *Corynebacterium* sp. and *Propionibacterium* sp. Several studies have examined the ability of bacteria to adhere to contact lenses. Subsequent to adhesion, it is likely that bacteria further colonize the lens surface by growing on that lens surface. These bacteria do not make up part of the normal ocular microbiota²².

Occasionally, adverse responses to contact lens wear occur such as microbial keratitis, contact lens-induced acute red eye, contact lens-induced peripheral ulcers, and in ulcerative keratitis²³. These adverse responses are frequently caused by bacterial contamination of the contact lens surface. One of the initial steps in the development of the bacterially driven adverse responses is the binding of bacteria to a contact lens. The present study has limited sample size and we had not conducted all microbial flora expected in contaminated contact lenses. In future, this study should be done on a large scale population for better results. As the covid pandemic has taken a toll on our lives, precautions need to be taken by dental practitioners which is of utmost importance to prevent contamination of microorganisms.

CONCLUSION

This study highlights the importance of protective face shields in the prevention of contamination of contact lenses. But, even after wearing a protective Face shield there was contamination of the contact lenses. Concluding from the results of this study, dental practitioners should avoid contact lenses as the risk of contamination from aerosols. In circumstances where contact lenses are used, it is recommended to wear protective Face Shield/Eyewear.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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