Efficacy of Listerine as a Pre-Procedural Mouth Rinse in Reducing Microbial Count in Dental Aerosol

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ABSTRACT
Background: Particles consist of solids and liquids with <50 µm in diameter were defined as aerosols. Particles of this size can be able to stay in air for a long period of time before they get settled on environmental surfaces or enter into the respiratory tract. This aerosol can penetrate and lodge in the lungs and can cause infections.

Objectives: To assess and compare the microbial count in dental aerosol before and after rinsing the mouth with Listerine mouthwash.

Materials and Methods: A cross-sectional study was conducted in 30 patients after obtaining informed consent. Ultrasonic scaling was done in 1st and 4th quadrant before giving mouth rinse and after rinsing the mouth with the Listerine for 30 s, Ultrasonic scaling was again done in 2nd and 3rd quadrant, and fall out samples were collected in the newly placed blood agar plates kept at 0.5 m and 1 m away from the patient. Blood agar plates were incubated at 37°C for 48 h after collecting the sample, and the microbial counting was done manually.

Results: The results shows that there is a significant reduction in the count of alpha hemolytic Streptococci, coagulase negative Staphylococci, Staphylococcus aureus, Klebsiella, and Citrobacter species in dental aerosol after rinsing with Listerine.

Conclusion: The present study clearly suggests that a routine pre-rinse with Listerine could be helpful in reducing microbial count in dental aerosol.

Key words: Aerosol, Chlorhexidine, Infection, Microbial count, Rinsing

INTRODUCTION
The spread of infection through aerosol and splatter has long been considered one of the main reason for possible transmission of infectious agents and their ill effects on the health of patients and dental health care professionals. A colloid which is formed of solids particles and liquids, which is having a diameter of <50 µm are called as aerosols. Particles of this size can be able to stay in air for a long period of time before they get settled on environmental surfaces or enter into the respiratory tract. The aerosol can penetrate and lodge in the lungs and can cause infections. Airborne particles of diameter more than 50 µm in diameter are known as splatter, which are ejected forcibly from the operating site, which are ejected forcibly from the operating site and are in a trajectory similar to that of a bullet until they contact a surface or floor. These particles are too large to become suspended in the air and hence settle down easily within a short period of time. The oral cavity consists of billions and billions of microorganisms, which can get transmitted from one person to another through water contamination, surface contact or through aerosols. Aerosols are generated during tooth preparation with a rotary instrument or air abrasion, during the use of an air-water syringe, ultrasonic scaler, and while doing air polishing. It is common for the patient to comment on this cloud of material.

All health care professionals including the dentists, dental hygienists, and nurses can get exposed to microorganisms present in patients’ blood, saliva and from instruments, which

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can lead to cross infections. The oral cavity harbors numerous bacteria and viruses from the respiratory tract, dental plaque, and oral fluids. Viruses which are present in aerosols such as human immunodeficiency virus hepatitis B can penetrate the conjunctiva, respiratory tract of clinician, assistant and patients in addition to this some viruses such as mumps, rubella, and influenza also poses a serious risk to the health care professionals. Any dental procedure that has a potential to aerosolize saliva will cause contamination of air with organisms from some or all of these sources. Along with mechanical plaque control aids, the use of antimicrobials in reducing microbial count in plaque is well-established. The potential routes for the spread of infection in a dental office are direct contact with body fluids of an infected patient, contact with environmental surfaces or from contaminated instruments. Only a few clinicians are only aware of the benefits of using antimicrobial mouth rinses in reducing microbial count in dental aerosol. Many studies have already proved that use of rubber dams, high-velocity evacuation, brushing before dental visit are helpful in reducing microbial count in dental aerosols. Therefore, the present study aims to find out the effectiveness of Listerine when used as a pre-rinse in reducing the microbial count in dental aerosols so that it can be used in preventing the spread of infections.

**Objective**

To assess and compare the microbial count in dental aerosol before and after rinsing the mouth with Listerine mouthwash.

**MATERIALS AND METHODS**

**Source of the Data**

After obtaining ethical approval from Ethical Committee of A. J. Institute of Medical Sciences, a total of 30 studies, subjects were included in the study based on inclusion and exclusion criteria. It was made clear to the potential subjects that participation will be voluntary and written informed consent was obtained from those who agreed to participate.

**Inclusion Criteria**

1. Subjects who have to undergo supragingival scaling
2. Subjects with a minimum of 20 permanent teeth.

**Exclusion Criteria**

Patients with medical conditions contraindicating the use of ultrasonic scaler
1. Communicable disease
2. Patients who are under systemic or topical antibiotics.

**Methodology**

The cross-sectional study was conducted in the Department of Public Health Dentistry, A. J. Institute of Dental Sciences, Mangalore. The procedure was explained to the patient, and informed consent was obtained. Before each Appointment all the operatory surface was cleaned and disinfected with cotton dipped in spirit. Before rinsing with the mouthwash, Ultrasonic scaling was done in the 1st and 4th quadrant before giving mouth rinse and fall out samples were collected in the sheep blood agar plates kept at a distance of 0.5 m and 1 m from the oral cavity. After rinsing the mouth with the Listerine for 30 s, Ultrasonic scaling was again done in the 2nd and 3rd quadrant and fall out samples were collected in the newly placed blood agar plates kept at 0.5 m and 1 m away from the patient. Treatment was carried out by placing 2 sterile agar plates uncovered at pre-designated sites to collect samples of aerosolized bacteria before and after mouth rinsing with antimicrobial mouthwash Listerine (Figures 1-4).

**Figure 1:** Ultrasonic scaling done

**Figure 2:** Aerosols collected in blood agar plates

**Figure 3:** Plates incubated at 37°C
Microbial Procedure
After the samples were collected, they were taken to the Department of Microbiology, A.J. Institute of medical Sciences for further analysis. About 10% sheep blood agar plates were used which were incubated at 37°C for 48 h after collecting the sample. Counting of the colony-forming units (CFU) was performed by the examiner, who was blinded regarding the time of exposure and location of agar plate. The microbial counting was done after that.

Statistical Analysis
Statistical analysis was done using SPSS (statistical package for social sciences) 17 and Wilcoxon signed rank sum test used for comparing pre- and post-intervention samples.

RESULTS
Table 1 shows the comparison of mean values of CFU in blood agar plates kept at 0.5 m with and without Listerine mouthwash. The results of the study show that a significant reduction in CFU in blood agar plates kept at 0.5 m after pre-rinsing with Listerine compared to blood agar plates kept at 0.5 m without rinsing. There is a significant reduction in mean values in CFU of alpha hemolytic Streptococci, coagulase negative Staphylococci, coagulase negative Staphylococci, Klebsiella and Citrobacter. The blood agar plates kept at a distance of 0.5 m before pre-procedural mouth rinsing with Listerine shows the highest number of CFU.

Table 2 shows the comparison of CFU with and without Listerine mouthwash in blood agar plates kept at a distance of 1 m. The mean reduction scores were highly significant ($P < 0.001$) in the post-intervention samples at 0.5 m and 1 m, respectively.

Graph 1 showing the comparison of mean values of CFU in agar plates with and without using Listerine in blood agar plates kept at a distance of 0.5 m. The mean values of pre- and post-intervention scores of the aerobic bacterial count in blood agar plates kept at 0.5 m and 1 m before and after rinsing with Listerine were compared, and the scores of post-intervention samples showed a significant reduction. Graph 1 indicates a reduction in mean CFU in blood agar plates kept at a distance of 0.5 m when Listerine was used as a pre-procedural mouth rinse.

Graph 2 indicates a reduction in mean CFU in blood agar plates kept at a distance of 1 m when Listerine was used as a pre-procedural mouth rinse. Graph 2 showing the comparison of mean values of CFU with and without using Listerine in blood agar plates kept at a distance of 1 m.

DISCUSSION
Almost all dental procedures involving the use of dental handpieces, ultrasonic scalers, air polishing devices and air abrasion units produce aerosols. The use of high-speed dental drill, ultrasonic scaler and water spray, can generate numerous

<table>
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<tr>
<th>Type of organism</th>
<th>Before rinsing</th>
<th>After rinsing</th>
<th>P value</th>
</tr>
</thead>
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<tr>
<td>Alpha hemolytic Streptococci</td>
<td>5016.667</td>
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<td>1733.33</td>
<td>101.33</td>
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<tr>
<td>Klebsiella</td>
<td>100</td>
<td>26</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Citrobacter</td>
<td>100</td>
<td>27</td>
<td>&lt;0.001</td>
</tr>
</tbody>
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CFU: Colony forming units

<table>
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<th>Before rinsing</th>
<th>After rinsing</th>
<th>P value</th>
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</thead>
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<td>&lt;0.001</td>
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<tr>
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<tr>
<td>Klebsiella</td>
<td>110</td>
<td>16.667</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Citrobacter</td>
<td>99</td>
<td>15</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

CFU: Colony forming units
airborne particles derived from blood, saliva, tooth debris, dental plaque, calculus, and restorative materials. A safe environment is hence, an important consideration in a dental clinic. The objectives of the present study were to assess the degree of aerosol contamination produced by an ultrasonic scaler at various distances with Listerine mouthwash as pre-rinse during associated dental procedures. The results of the present study showed that when Listerine was used as a pre-rinse before the scaling procedure, only fewer colony-forming units developed in blood agar plates. These results agree with those reported by Muir⁸ who found a 2 min pre-rinse with antimicrobial mouthrinse found to be effective in reducing microbial contamination in aerosols generated by ultrasonic scalers. The present study results also agree with those documented by Bay⁹ who found rinsing immediately before the scaling procedure with a 30 s pre-rinse of antiseptic mouthwash to be effective in reducing microbial count in dental aerosols. During ultrasonic scaling without pre-rinsing with Listerine water, the highest number of colonies was seen on the plates positioned at 0.5 m from patients mouth, which is in conformity with the study done by Veksler and Kayrouz¹⁰ where it was concluded that the larger salivary droplets generated during dental procedures settle down rapidly from the air with heavy contamination seen near patient’s chest area. Results of our study showed that after rinsing the mouth before procedure with an antiseptic mouthwash can significantly reduce the number of viable bacteria in dental aerosol which is in concurrence with the study done by Fine.¹¹ A routine pre-rinsing with any antimicrobial mouth rinse like Listerine may have potential in office use as part of an infection control regimen in minimizing the Contamination of bacterial aerosols generated during the dental procedures.¹²,¹³ However, results of the present study clearly suggest that Listerine is an effective measure in reducing aerosol cross-contamination during ultrasonic scaling in the practice of dentistry. The limitations of this study should be considered in interpreting these results. The colony forming units counted here are values that represent only aerobic bacteria capable of growth on blood agar plates; viruses, anaerobic bacteria and organisms requiring specialized media were not cultured in this study. Since, the plates were kept open during the entire scaling procedure there is chance of contamination by the microorganisms present in the atmosphere.

CONCLUSION
This study clearly suggests that a routine pre-rinse with Listerine could be helpful in reducing microbial count in dental aerosol. However, since it is virtually impossible to completely eliminate the risk posed by dental aerosols; it is possible to minimize the risk posed by the same along with the universal precautions.

REFERENCES