ABSTRACT

Aim: To evaluate and compare the efficacy of preprocedural mouthrinses (chlorhexidine digluconate and tea tree oil) in reducing microbial content of aerosol product during ultrasonic scaling procedures by viable bacterial count.

Settings and design: It was a randomized single blind, placebo-controlled parallel group study.

Materials and methods: Sixty subjects were randomly assigned to rinse 10 ml of any one of the mouthrinses (chlorhexidine digluconate or tea tree oil or distilled water). Ultrasonic scaling was done for a period of 10 minutes in presence of trypticase soy agar plates placed at standardized distance. Plates were then sent for microbiological evaluation for the aerosol produced.

Results: This study showed that all the antiseptic mouthwashes significantly reduced the bacterial colony forming units (CFUs) in aerosol samples. Chlorhexidine rinses were found to be superior to tea tree when used preprocedurally in reducing aerolized bacteria.

Conclusion: This study advocates preprocedural dural rinsing with an effective antimicrobial mouthrinse during any dental treatment which generates aerosols, reduces the risk of cross-contamination with infectious agents in the dental operatory.

Clinical significance: The aerolization of oral microbes occurring during dental procedures can potentially result in cross-contamination in the dental operator and transmission of infectious agents to both dental professionals and patient. It is reasonable to assume therefore, that any stratagem for reducing the viable bacterial content of these aerosols could lower the risk of cross-contamination.

Keywords: Chlorhexidine digluconate, Tea tree oil, Aerosol, Colony forming unit.

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MATERIALS AND METHODS

Sixty subjects from both genders with the age ranging from 25 to 45 years were selected from the outpatients visiting the Department of Periodontics. The study was approved by the Institutional Ethics Committee. Written informed consent was taken from subjects selected. A detailed medical history and dental examination was done on each volunteer to fulfill the requirements of following inclusion and exclusion criteria.

The study included patients having a minimum of 20 permanent teeth. Patients having an oral hygiene score (Green and Vermillion; 1960) between 1.3 and 3, plaque index (Silness and Loe 1964) between 1 and 2, gingival index score (Loe and Silness 1963) between 1 and 2 were selected for study. Patients with cardiac pacemakers, resin restorations, suffering from conditions requiring prophylactic antibiotics, prior to dental procedures or currently using antibiotics or history of antibiotic usage in past 6 months and with any history of systemic diseases were excluded from the study.

STUDY DESIGN

It was a randomized single blind, placebo-controlled parallel group study. Each subject was chosen at random to enter one of the treatment groups using random number table. The treatment group includes:

- **Group 1**: Comprised of 20 patients who rinsed with distilled water (control group).
- **Group 2**: Comprised of 20 patients who rinsed with 0.2% chlorhexidine digluconate (Rexidine®).
- **Group 3**: Comprised of 20 patients who rinsed with tea tree oil (Emoform®).

The latter two groups comprised the test group.

Procedure

All the selected cases were subjected to ultrasonic scaling. Prior to the procedure the surfaces of the operatory were disinfected with ethyl alcohol (70%). Trypticase soy agar plates were selected as a medium to collect the aerosol and further the same plates were used as culture media for assessing the total colony forming units (CFUs). A metal framework was custom-made. This framework consisted of three metal rods onto which aluminum trays were fixed. The framework was fixed on to the hand rest of the dental chair. The same dental chair with the fixed framework was used throughout the study. The sole objective of the framework was to standardize the distance of the trypticase soy agar plates from the reference point (the mouth of the patient). The standardized distance was maintained throughout the study. Subjects were randomly given mouthrinse to rinse before the procedure.

PLATE POSITION

Plate placed at 6 inches (half feet) from reference point (operator’s nose level).
- Plate placed at 6 inches (half feet) from reference point (dental assistant’s nose level).
- Plate placed at 12 inches (1 feet) from reference point (patients chest level).

Prior to the procedure, the ultrasonic unit was switched on and flushed for a period of 2 minutes as directed by the manufacturer in order to get rid of contaminated water due to overnight stagnation in the water lines.

Microbiological Examination

The trypticase soy agar plates containing the aerosol sample were subjected to aerobic culturing.

Aerobic Culturing

The trypticase soy agar plates were placed in an incubator and incubated at 37°C for 24 hours.

STATISTICAL ANALYSIS

The data collected were analyzed using Kruskal-Wallis test and Mann-Whitney U test for percentage reduction in CFUs as distance increases and percentage difference in CFUs between various groups respectively.

RESULTS

The mean CFUs of the control and the test groups at the distance of 6 inches from the operator nose level, 6 inches from the dental assistant’s nose level, 12 inches from the patient chest level respectively were depicted in Graphs 1, 2 and 3 respectively.

Comparison of mean CFUs of group 1 (control) with group 2 (chlorhexidine) showed a Z-value of 5.412 and
p-value of <0.001 and 20.8006% difference which was found to be highly significant (Table 1). Comparison of mean CFUs of group 1 (control) with group 3 (tea tree oil) showed a Z-value of 3.274 and p-value of <0.001 and 6.7257% difference which was found to be highly significant (Table 1).

Values of mean aerobic CFUs group 1 preprocedural rinse with group 2 preprocedural rinse showed that group 2 preprocedural rinse was more effective than group 1 preprocedural rinse and comparison of mean aerobic CFUs group 1 preprocedural rinse with group 3 preprocedural rinse showed that group 3 preprocedural rinse was more effective than group 1 preprocedural rinse. The values obtained showed that all test rinses were more effective than the control rinse.

Comparison of mean aerobic CFUs group 2 (chlorhexidine) with group 3 (tea tree oil) showed a Z-value of 5.387 and p-value of <0.001 and 27.7263% difference which was found to be highly statistically significant.

**DISCUSSION**

The oral cavity is a unique environment which provides an ideal medium for bacterial growth. As a result of repeated exposures to these microorganisms present in blood and saliva the dental health professional is placed at a higher risk for developing certain infectious diseases. Certain dental procedures like ultrasonic scaling procedure produce aerosols which cause marked changes in the microbial levels of the surrounding air. Aerosols hence act a medium for transfer of infectious agents from one person to another thus aiding in cross infection. This study consisted of rinsing with 10 ml of any one of the mouthrinses under study for a period of 2 minutes following which ultrasonic scaling was carried out on a quadrant for a period of 10 minutes. During the sampling period aerosol generated was collected using trypticase soy agar plates.

The aerosol sample, on microbiological examination gave a fair idea about the percentage decrease in the total number of CFUs. Subjects who rinsed with distilled water (control rinse), the mean aerobic microbial CFUs during aerosol sampling period were 131.1500, 120.85 and 50.75 at a distance of 6 inches from the operator nose level, 6 inches from the dental assistant’s nose level, 12 inches from the patient chest level respectively (Graph 1). Subjects who rinsed with chlorhexidine digluconate (0.2%). The mean aerobic microbial CFUs during aerosol sampling period were 10.35, 8, 1.35 at a distance of 6 inches from the operator nose level, 6 inches from the dental assistant’s nose level, 12 inches from the patient chest level respectively (Graph 2). Patients who rinsed with tea tree oil, the mean aerobic microbial CFUs during aerosol sampling period was 24.8, 20.25 and 10.55 at a distance of 6 inches from the operator nose level, 6 inches from the dental assistant’s nose level, 12 inches from the patient chest level respectively (Graph 3). The observation from the values of the control and test groups indicate that as the distance increases the number of CFUs produced by aerosol significantly decreases (6 inches
from operators nose level and dental assistant’s nose level to 12 inches from the patient’s chest level). This observation is in accordance with the study done by Logothesis DD, Martinez W in 1995 wherein agar plates were placed at eight standardized locations to collect aerosols. The results of their study showed the number of CFUs decreased as the distance increased from reference point.1

On comparison of the mean values between chlorhexidine and control group, a difference of 20.8006% (Table 1) in aerobic CFUs with p-value <0.001 (VHS) was found. Hence, the chlorhexidine rinse was found to be better than the control rinse in reducing microbial CFUs. These findings were in accordance with the study done by Alberto, Ghassan and Kayrouz in 1991 to assess the effect of preprocedural rinsing with chlorhexidine which has found to have a profound and sustained effect on the aerobic and facultative flora of the oral cavity which may contribute to a variety of clinical benefits.2

On comparison of the values between tea tree oil and control group, a difference of 6.7257% (Table 1) with the p-value <0.001 (VHS) was found. Hence, tea tree oil was found to be better than the distilled water (control rinse). This may be due to the antimicrobial activity of tea tree oil.3

Comparison of results obtained in group 2 [chlorhexidine gluconate (0.2%)] and group 3 (tea tree oil) showed a statistically significant difference between the two groups 27.7263% (see Table 1). This may be due to the effectiveness of chlorhexidine which has a broad spectrum antimicrobial effect coupled with its property of substantively which prolongs its antibacterial action when compared to tea tree oil which has limited substantivity property.4,5

However, these results contradict the study by Evakulik and Krystyna in 2000 that showed the minimum inhibitory concentration (MIC) and minimum bacterial/fungicidal concentration (MBFC) of tea tree oil required for its antimicrobial effect on broad spectrum Gram-negative and Gram-negative bacteria was less compared to chlorhexidine.6

**CONCLUSION**

This study showed that all the antiseptic mouthwashes reduced the bacterial CFUs in aerosol samples. Chlorhexidine rinses were found to be superior to tea tree when used preprocedurally in reducing aerolized bacteria.

**CLINICAL SIGNIFICANCE**

The findings of this clinical study strictly advocate preprocedural rinsing with an effective antimicrobial mouthrinse to be made compulsory during any treatment which generates aerosols, thus reducing the risk of cross-contamination with infectious agents in the dental operatory.

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**REFERENCES**


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