10.5005/jp-journals-10024-1414
ORIGINAL RESEARCH

Compare the Efficacy of Two Commercially Available Mouthrinses in reducing Viable Bacterial Count in Dental Aerosol produced during Ultrasonic Scaling when used as a Preprocedural Rinse

Shamila K Shetty, Karanth Sharath, Santhosh Shenoy, Chandini Sreekumar, Rashmi N Shetty, Thomas Biju

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 operatory 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.

How to cite this article: Shetty SK, Sharath K, Shenoy S, Sreekumar C, Shetty RN, Biju T. Compare the Efficacy of Two Commercially Available Mouthrinses in reducing Viable Bacterial Count in Dental Aerosol produced during Ultrasonic Scaling when used as a Preprocedural Rinse. J Contemp Dent Pract 2013;14(5):848-851.

Source of support: Nil

Conflict of interest: None

INTRODUCTION

Professional interest has developed concerning aerosols produced microbes and their potential for disease transmission to clinicians and patients. Assuring the patient and operator of a reduced risk to cross-contamination is critical in maintaining today's dental practice.[1] There are at least three potential sources of airborne contamination during dental treatment: dental instrumentation, saliva and respiratory sources, and the operative site. One of the major source for contamination is bacteria in dental plaque which is harbored in the periodontal pocket. As part of this complex, the mouth harbors bacteria and viruses from the nose, throat and respiratory tract. Any dental procedure that has the potential to aerosolize saliva will cause airborne contamination with organisms from some or all of these sources. The most serious potential threat present in aerosols is *Mycobacterium tuberculosis*, the organism that causes tuberculosis.[2] The aerolization of oral microbes which occur during certain dental procedures can potentially result in cross-contamination in the dental operatory and transmission of infectious agents to both dental professionals and their patient. It is reasonable to assume therefore, that any stratagem for reducing the viable bacterial content of these aerosols could lower the risk of such cross-contamination.[3] Hence, the objective of this study was to compare the efficacy of two commercially available mouthrinses in reducing viable bacterial count in dental aerosol produced during ultrasonic scaling when used as a preprocedural rinse.

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.[4] 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 dentalchair. The same dentalchair 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.

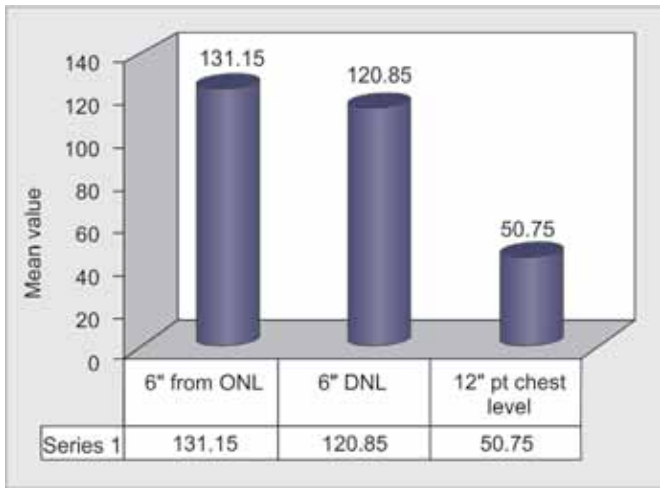
STATISTICAL ANALYSIS

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.

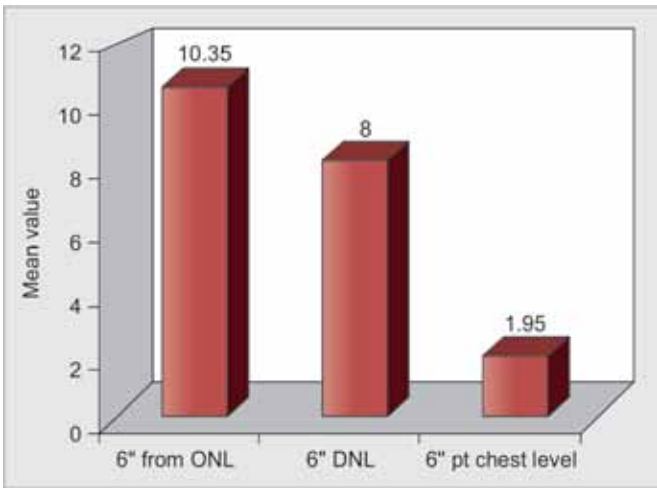
RESULTS

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.

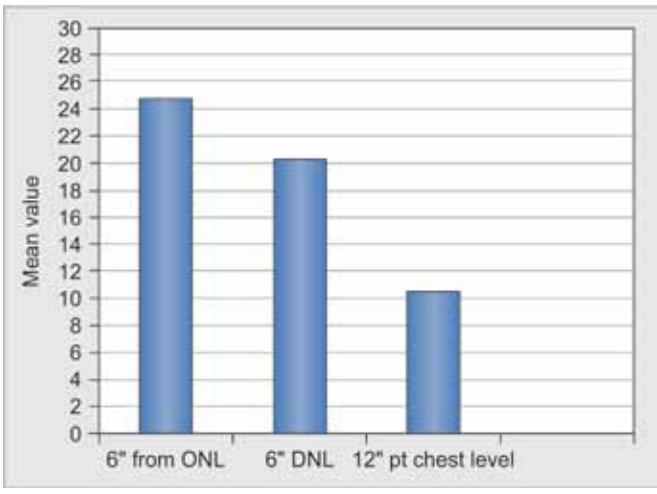
Comparison of mean CFUs of group 1 (control) with group 2 (chlorhexidine) showed a Z-value of 5.412 and



Graph 1: Comparison of mean CFU's in distilled water (ONL: Operator's nose level; DNL: Dental assistant's nose level; Pt chest level: Patient's chest level)



Graph 2: Comparison of mean CFU in CHX (ONL: Operator's nose level; DNL: Dental Assistant's nose level; Pt chest level: Patient's chest level)



Graph 3: Comparison of mean CFU in tea oil (ONL: Operator's nose level; DNL: Dental Assistant's nose level; Pt chest level: Patient's chest level)

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 significant (Table 1).

Values of mean aerobic CFUs group 2 preprocedural rinse with group 3 preprocedural rinse showed that group 2 preprocedural rinse was more effective than group 3. Results indicate that chlorhexidine digluconate was more effective than tea tree oil that was found to be highly statistically significant.

Table 1: Comparison of the percentage difference in CFUs between various groups

Comparison group	*Test statistic Z*	*p-value*	*Difference in CFU (%)*
1 *vs* 2	5.412	<0.001 VHS	20.8006
1 *vs* 3	3.274	<0.001 VHS	6.7257
2 *vs* 3	5.387	<0.001 VHS	27.7263

Significance: p < 0.001; VHS: Very highly significant; p < 0. 01: highly significant; p > 0.05: not 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.[5] 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 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.[6]

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.[7]

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 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.[7,8]

However, these results contradict the study by Evakulik and Krystyna in 2000 that showed that 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.[9]

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.

REFERENCES

1. Logothetis DD, Martinez-Welles JM. Reducing bacterial aerosol contamination with a chlorhexidine gluconate pre-rinse. J Am Dent Assoc 1995;126:1634-1639.
2. Harrel SK, Molinari J. Aerosol and splatter in dentistry. J Am Dent Assoc 2004;135(4):429-437.
3. Fine DH, Mandieta C, Barnett ML. Efficacy of preprocedural rinsing with an antiseptic in reducing viable bacteria in dental aerosols. J Periodontol 1992;63:821-824.
4. Peto R, Pike MC, Armitage P, Breslow NE, Cox DR, Howard SV, et al. Design and analysis of randomized clinical trials requiring prolonged observation of each patient. Br J Cancer 1976;34:585-612.
5. Centers for disease Control. Recommended infection–control practices for dentistry. Morbidity and mortality weekly report. US Department of Health and Human Services1993;41 (No. RR-8):1-12.
6. Veksler AE, Ghassan A. Reduction of salivary bacteria by preprocedural rinses with chlorhexidine 0.12%. J Periodontal 1991;62:649-651.
7. Arweiler NB, Donos N, Netuschil L, Reich E, Sculean A. Clinical and antibacterial effect of tea tree oil—a pilot study. Clin Oral Invest 2000;4:70-73.
8. Addy M, Use of antiseptics in periodontal therapy. IN: Lindhe J, Thorklid K, Niklaus PL. Clinical periodontology and implant dentistry-4 edition (New Delhi); Blackwell, Munksgaard; 2003;p.464-493.
9. Kulik E, Lenkeit K, Meyer J. Antimicrobial effect of tea tree oil (Melaleuca alternifolia) on oral microorganisms. Schweiz Monatsschr Zahnmed 2000;110(11):125-130.

ABOUT THE AUTHORS

Shamila K Shetty (Corresponding Author)

Assistant Professor, Department of Periodontics, AB Shetty Memorial Institute of Dental Sciences, Nitte University, Mangalore, Karnataka India, Phone: +919901121270, e-mail: shetty.shamila@gmail.com

Karanth Sharath

Professor, Department of Periodontics, AB Shetty Memorial Institute of Dental Sciences, Nitte University, Mangalore, Karnataka, India

Santhosh Shenoy

Reader, Department of Periodontics, AB Shetty Memorial Institute of Dental Sciences, Nitte University, Mangalore, Karnataka, India

Chandini Sreekumar

Assistant Professor, Department of Periodontics, AB Shetty Memorial Institute of Dental Sciences, Nitte University, Mangalore, Karnataka India

Rashmi N Shetty

Assistant Professor, Department of Periodontics, AJ Institute of Dental Sciences, Mangalore, Karnataka, India

Thomas Biju

Professor and Head, Department of Periodontics, AB Shetty Memorial Institute of Dental Sciences, Nitte University, Mangalore, Karnataka India