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Research Paper

Effectiveness of chlorhexidene and herbal extracts containing mouthwashes in reducing bacteria in dental aerosols: Randomized Clinical trial

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ABSTRACT: *Background: During scaling and root planing procedure aerosol production has been known as potent source of infection. Thus, the aim of the present study was to evaluate and compare the efficacy of two different mouthwashes containing Chlorhexidine and Herbal extracts by using them as preprocedural rinsing agent in reducing the bacterial load of the aerosol produced by ultrasonic scaler.*
Materials and Methods: 45 subjects, age and gender matched were randomly divided into three groups on the basis of agents used for preprocedural mouthrinsing - Group I: Distilled Water (Control), Group II: Chlorhexidine (CHX), Group III: Herbal extracts (HR). The aerosols were collected on three previously prepared and sterilised blood agar plates at three different positions in the operatory. The colony forming units were counted after incubating the plates for 48 hours.
Results: At all locations, the mean CFU was highest in Group I followed by Group III and Group II.
Conclusion: 0.2 % chlorhexidine was found to be most effective preprocedural mouthwash in reducing the bacterial load in the aerosol produced during ultrasonic scaling followed by herbal mouthwash and distilled water.
KEYWORDS*: Aerosols, Chlorhexidene, Herbal extracts, Mouthwash*

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I. INTRODUCTION

Cross-contamination and the potential for disease transmission to clinicians and patients from the aerosols produced in the dental office have been of great concern worldwide. The spread of infection through aerosol and splatter has long been considered one of the main concerns in the dental community because of possible transmission of infectious agents and their potential harmful effects on the health of patients and dental personnel.[1]Aerosols generated by dentists in their work may contain solid particles and chemicals or gasses as well as bacteria and viruses.[2]

Aerosol is a suspension of solid or liquid particles containing bacteria or viruses, suspended for at least a few seconds in a gas. Particle size may vary from 0.001 to >100 mm.[3] The
smaller particles of an aerosol (0.5–100 μm in diameter) have the potential to penetrate and lodge in the smaller passages of the lungs and are thought to carry the greatest potential for transmitting infections.[1]

Literature reveals that significant amounts of bacterial aerosol contamination are produced by the use of ultrasonic scalers and high-speed handpieces [4-6]. The ultrasonic scaler tip produces both small and large particles. Several studies have reported the association of these aerosols with respiratory infections, ophthalmic infections, skin infections, tuberculosis and hepatitis B.[7]

Harrel and Molinari [8] recommend three levels of defense in the reduction of aerosols. The first recommended layer of defence is a personal protective barrier such as mask, gloves, and safety glasses. The second layer is routine use of an antiseptic preprocedural rinse. The final layer is the use of high evacuation device. Personal protective barriers and high evacuation devices are routinely used in the dental office to prevent aerosol contamination and preprocedural rinses are not commonly used.

The present study was designed to evaluate and compare the efficacy of two different mouthwashes containing chlorhexidene and herbal extracts using them as preprocedural rinsing agent in reducing the bacterial load of the aerosol produced by ultrasonic scaler.

II. MATERIALS AND METHODS

A total of 45 participants (males and females) were selected from the outpatient clinic of Department of Periodontics, Indira Gandhi Govt. Dental College Jammu .

Inclusion criteria included patients who were scheduled for ultrasonic scaling and were having a minimum of 24 permanent teeth and a mean plaque score of 2.0–3.0 on plaque index

(PI). Participants exhibiting good overall general health, non-smokers, no history of periodontal treatment for the past 6 months, no history of antimicrobial therapy for the past

6 months, and no history of hypersensitivity to any drugs were included in the study. Pregnant and lactating females, patients with a history of trauma in the past 6 months, patients on phenytoin, calcium channel blockers, and cyclosporine medication, immunocompromised patients, or patients suffering from chronic systemic disease were excluded from the study.

An informed and written consent was obtained from each patient willing to participate in the study. The ethical clearance was obtained from the ethical committee of the institute prior to the study.

Selected patients were randomly divided into three groups having 15 patients each. Group I (control group) – The patients were asked to rinse with sterile water for 60 s 10 min before ultrasonic scaling. Group II (CHX group) – The patients were asked to rinse with 10 ml of 0.2% chlorhexidine mouthwash (Rexidine®, Indoco Remedies Limited, Mumbai, Maharashtra, India) for 60 s 10 min before ultrasonic scaling. Group III (HR group) – The patients were asked to rinse with 15 ml of mouthwash containing herbal extracts (HiOra®, Himalaya Herbal Healthcare, Bengaluru, Karnataka, India) for 60 s 10 min before ultrasonic scaling.

Ultrasonic scaling was carried out in all the patients after preprocedural rinsing by a single- qualified dental professional in previously disinfected operatory. While the patients were undergoing treatment, the aerosols were collected on three previously prepared and sterilized blood agar plates by fixing the plates on operators chest (OC), patients chest (PC), and ata distance of 4 feet at 4 "O" clock position (FF). The blood agar plates were incubated for 48 hours and were inspected for the number of bacterial colony-forming units (CFUs). All the samples on the blood agar plate were evaluated by the same investigator. In the presentstudy, only the number of bacteria in the aerosol was assessed and not the type of bacteria. The recorded data were statistically analyzed.

III. RESULTS

The demographic data (age and sex) and clinical characteristics (number of teeth present, PI, and probing depth) of three groups (control, CHX and HR) are summarized in Table 1.

Table 1: Demographic and clinical characteristics

Characteristics		**Group I [n=15]**	**Group II [n=15]**	**Group III [n=15]**
Age (years)		36.2±3.84	35.1±4.26	37.2±5.82
Gender	Male	9 (60)	8 (53.3)	9 (60)
	Female	6 (40)	7 (46.7)	6 (40)
Number of teeth		29.4±0.93	28.5±1.25	29.1±1.32
PI		2.39±0.32	2.42±0.28	2.40±0.21
PD (mm)		3.83±0.73	4.01±0.82	3.95±0.52

Group I: Control, Group II: Chlorhexidine , Group III: herbal extracts mouthwash
PI: Plaque Index, PD: Probing Depth

The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to data editor of SPSS Version 20.0 (SPSS Inc., Chicago, Illinois, USA). Continuous variables were expressed as Mean±SD and categorical variables were summarized as percentages. Analysis of variance (ANOVA) was employed for inter group analysis of data and for multiple comparisons, Tukey's post hoc test was applied. Chi-square test was used for comparison of categorical variables. Graphically the data was presented by bar and diagrams. A P-value of less than 0.05 was considered statistically significant.

The mean CFU of three groups (I, II and III) at three locations (OC, PC, and FF) was counted and analyzed after 48 hours and is summarized in Table 2 .

Table 2- Colony-forming units of three groups at three different locations after 48 h.

Location of agar plate	Group I [n=15]	Group II [n=15]	Group III [n=15]	P-value
OC	231.6±29.83	104.6±21.71	189.3±29.87	<0.001*
PC	259.4±32.64	103.7±24.65	193.5±32.61	<0.001*
FF	59.7±13.51	26.3±6.89	47.8±11.51	<0.001*

Group I: Control, Group II: Chlorhexidine , Group III: Herbal extracts
*Statistically Significant Difference (P-value<0.05)

Table 3: Inter-group comparison of colony-forming unit by Tukey test after 48 hours

Comparison	OC	PC	FF
Group I vs Group II	<0.001*	<0.001*	<0.001*
Group I vs Group III	0.017*	<0.001*	0.174
Group II vs Group III	<0.001*	<0.001*	0.029*

*Statistically Significant Difference (P-value<0.05)

At all locations, the mean CFU was highest in Group I followed by Group III and Group II. For each location, comparing the mean CFU between the groups, ANOVA revealed significantly ($P < 0.001$) different CFU among the groups [Table 2]. Further, Tukey test showed that the mean CFU at both OC and PC lowered significantly ($P < 0.05$ or $P < 0.001$) in Group II and III as compared to control group (Group I) [Table 3].

IV. DISCUSSION

The control and reduction in the number of microbial aerosols is of a great concern to the dental personnel. Various studies have shown an association between these aerosols and systemic infections like respiratory infection, ophthalmic infections, tuberculosis and Hepatitis B infection [7]. As these microbial aerosols pose a potential risk for spread of infection, the need of means to reduce the bacterial load in the aerosols is often warranted, for which, various antimicrobial pre-procedural rinses have been tried. The present study was carried out to compare the efficacy of two mouthwashes in reducing the bacterial count in the aerosol produced during ultrasonic scaling.

CHX 0.2% is highly effective in inhibiting subgingival plaque formation and hence prevents development of gingivitis.[9-11] It has a broad spectrum of antimicrobial activity ranging from Gram-positive organisms, Gram-negative organisms, yeasts, dermatophytes to some viruses. Apart from the above benefits, it also possesses excellent substantivity property and hence is considered as gold standard mouthwash.[12] HiOra mouthwash is a nonalcoholic HR preparation made from natural herbs with their beneficial anticariogenic, antiplaque, antibiotic and anti-inflammatory properties.[13]

The present study demonstrates that the patient, operator, and people present in the operatory are exposed to a high amount of bacteria during the procedure of ultrasonic scaling. The microbial load of aerosol reduced significantly in both the groups after preprocedural mouthwash usage in comparison to the control group. The analysis of CFUs after 48 h revealed that CHX was most effective in reducing the bacterial counts in the aerosol followed by HR mouthwash.

A study conducted by Fine et al. has reported that the use of various plaque control agents as preprocedural mouthwash is effective in reducing bacterial count in aerosol when compared with distilled water or saline.[14] Thus, the result of this study was in accordance
to the present study.

In another study conducted by Southern EN et al. to compare the effects of 0.12% CHX rinse with HR mouthwash on gingival health reported CHX to be more effective in reducing bacterial population and thereby greater reduction in gingival inflammation.[15] The results of the present study also report CHX superior to HR mouthwash in bacterial population reduction in the aerosol produced during ultrasonic scaling. Thus, the result of this study was in accordance to the present study.

These observations reinforce the importance of using personal protective equipment like eye and face shields, head cap, mouth masks, glove, gowns and validates the use of pre-procedural mouthrinsing with an antimicrobial mouthwash as an additional barrier to minimize the risk of cross-contamination during ultrasonic scaling.

The limitation of this study is that we have just counted the aerobic bacteria capable of growth on agar plates. The anaerobic bacteria and viruses have not been included in the
study.

V. CONCLUSION

The aerosol production cannot be totally eliminated during ultrasonic scaling, but the putative potential of these aerosols can be minimized by preprocedural rinsing. 0.2 % chlorhexidine was found to be most effective preprocedural mouthwash in reducing the bacterial load in the aerosol produced during ultrasonic scaling followed by herbal mouthwash and distilled water.

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