



A Comparative Evaluation of Efficacy of 0.2% Chlorhexidine with a Herbal Mouthwash as Pre-Operational Mouthrinse in the Reduction of Aerosol Contamination Produced by Ultrasonic Scaler

Guntaas Sethi* and Kunal Kumar

Department of Periodontics, The Oxford Dental College and Hospital, Bangalore, India

*Corresponding Author: Guntaas Sethi, Department of Periodontics, The Oxford Dental College and Hospital, Bangalore, India.

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Abstract

Aim: a) To compare the efficacy of pre-procedural rinse with 0.2% chlorhexidine with that with a herbal mouthwash in reducing the aerosol contamination at two different locations- at the patient's chest area and the operator's chest area.

Materials and Methods: Twenty patients aged 20 - 55 years with chronic periodontitis were divided randomly into two groups of ten patients each to receive either a 0.2% chlorhexidine or a herbal mouthrinse as a pre-procedural rinse. The aerosol produced by the ultrasonic unit was collected at the patient's chest area, another at the doctor's chest area with an average distance of 12 inches from the patient's mouth on blood agar plates. The blood agar plates were incubated at 37 degrees for 48 hours. Following which, the total number of colony forming units (CFUs) were counted.

Results: The results revealed that 0.2% chlorhexidine pre-procedural rinse showed a greater reduction in CFUs at both the locations as compared to the herbal mouth rinse (p-value < 0.0001). The Number of CFUs were higher at the patient's chest location as compared to the doctor's chest location (p-value < 0.001)

Conclusions: 0.2% chlorhexidine pre-procedural rinse is more effective in reducing aerosol contamination as compared to herbal mouthwash. Also, the patient's chest location is more exposed to microbial aerosols as compared to doctor's chest location.

Keywords: Dental Aerosol; Splatter; Pre-Operational Mouthrinse; Chlorhexidine Mouthwash; Herbal Mouthwash; Colony Forming Units

Abbreviations

CFUs: Colony Forming Units; PI: Plaque Index; CHX: Chlorhexidine

Introduction

Generation of aerosols and splatter in a dental operatory promotes an increased risk of spread of infection and hence is a potential threat to the operator, dental auxiliary and the patients [1]. Aerosol is a suspension of solid or liquid particles containing various microorganisms like bacteria, viruses or fungi, suspended in a gas. The particle size of aerosol may vary from 0.001 to > 100 µm [2].

Miller [3] in 1976 found that aerosols generated from a patient's mouth contained up to a million bacteria per cubic foot of the air. There is some evidence for greater prevalence of respiratory diseases [4-6] and elevated levels of antibodies to *Legionella pneumophila* [7] in dental workers. Other studies have found an association between aerosols and respiratory infection, Tuberculosis, hepatitis B infection [8]. It was also found that microorganisms could survive in the aerosol for as long as 6 days, thus posing a danger of exposure for the clinicians and subsequent patients [9-11].

Therefore, to prevent any potential risk for the spread of infection by aerosols, various methods like using high vacuum suction, patient positioning, use of rubber dams and pre-procedural antimicrobial mouthrinse have been tried. Use of antibacterial mouthwash as a means of reducing aerosols has been investigated [10,12] and the literature suggests that use of such means may decrease the microbial aerosols generated by the ultrasonic scalers.

Chlorhexidine mouthrinse is considered the gold standard of antimicrobial mouthrinses due to its broad spectrum of action and its substantively [13-16]. In spite of these advantages, chlorhexidine mouthrinse has various side effects like staining of teeth, temporary loss of taste, dryness and soreness of mucosa, bitter taste and a slight increase in supragingival calculus formation [17].

Herbal products have attracted millions of consumers due to them over the counter availability and due to their minimal adverse effects [18]. It has been found that herbal products have active ingredients that have medicinal properties and can be utilized to restore the state of health. The herbal mouthrinse (HiOra® mouthwash, Himalaya) used in the present study is a polyherbal formulation of active ingredients like the extracts of *Salvadora persica*, Piper betel and *Terminalia bellerica*. *S. persica* has dem-

onstrated improvement in the gingival health and inhibition in the growth of cariogenic bacteria like *Staphylococcus aureus*, *Streptococcus mutans*, *Streptococcus faecalis*, *Streptococcus pyogenes*, *Candida albicans*, *Pseudomonas aeruginosa*, *Lactobacillus acidophilus*, thus helpful in minimizing plaque formation [19,20]. Various in vitro studies have also demonstrated the plaque inhibitory activity of piper betel [21], *Terminalia bellerica* [22] and *Gaultheria fragrantissima* [23].

Hence, considering the evidence available, the present investigation was designed with the aim. To compare the efficacy of pre-procedural rinse of 0.2% chlorhexidine mouthwash with a herbal mouthwash in reducing the aerosol contamination at two different locations- patient's chest area and the operator's chest area.

Materials and Methods

The protocol for the study was approved by the ethical committee of The Oxford Dental College, Bangalore. This study was conducted on patients with chronic periodontitis who visited the department of periodontology in The Oxford Dental College, Bangalore. Twenty patients with the age range of 20 - 55 years were recruited in the study. They were informed about the study and their inclusion was purely voluntary.

Inclusion criteria included- 1) presence of a minimum of 20 permanent teeth, 2) four or more sites with probing pocket depth of more than or equal to 4 mm, 3) Non-smokers, 4) systemically healthy individuals

Patients on topical or systemic antibiotics, patients with a history of oral prophylaxis within the last 3 months, pregnant or lactating women were excluded from the study.

The above mentioned 20 patients were randomly divided into two groups:

- Group A: This group comprised of 10 patients who rinsed with 10 ml of 0.2% chlorhexidine (Hexidine® mouthwash, ICPA) pre-procedural rinse for 60 seconds.
- Group B: This group comprised of 10 patients who rinsed with 10 ml of herbal (HiOra® mouthwash, Himalaya) pre-procedural mouthrinse for 60 seconds.

Before the start of study, fumigation of the closed dental operatory with potassium permanganate and formaldehyde was carried out and before each appointment, disinfection of all the surfaces using 70% isopropyl alcohol was done. The same closed operatory was used for all treatment procedures.

Ten minutes before the start of the professional treatment with ultrasonic scalers, the patients were asked to rinse with 10 ml of the respective mouthrinses for 60 seconds. The patients were examined for Plaque Index (PI) and other parameters.

Blood agar plates were used to collect the airborne micro-organisms. Two standardized locations of the operatory were chosen to

be evaluated for each treatment group. One was positioned at the patient's chest area, another at the doctor's chest area with an average distance of 12 inches from the patient's mouth to the blood agar plate.

Each treatment session consisted of 30 minutes of ultrasonic scaling by the same dentist. Only one patient was treated per day to allow the room to be free of aerosols. The scaling was performed using a piezoelectric ultrasonic scaler and a motorized suction was used. During the treatment and for 45 minutes after the treatment, the two coded blood agar plates were left uncovered at the pre-designated sites to collect samples of any aerosolized bacteria. After the collection of the samples, the blood agar plates were incubated at 37 degrees Celsius for 48 hours. Following which, the number of colony forming units on the blood agar plate was counted by a microbiologist who was blinded to the treatment groups.



Figure 1: Position of agar plates.

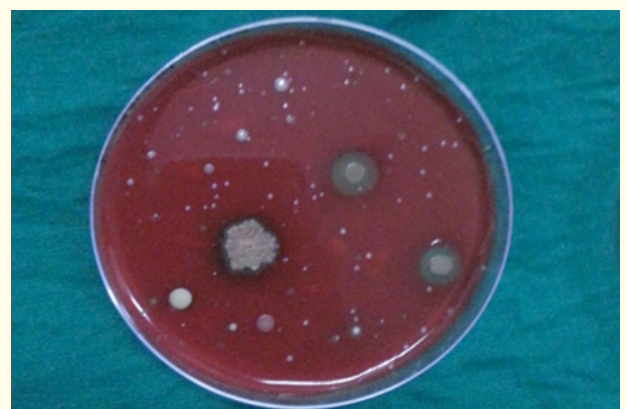


Figure 2: Microbial colonies formed on agar plate.

Results and Discussion

All the data collected was subjected to statistical analysis; Independent t-test was performed to compare the baseline clinical and demographic variables between the two groups. Two-way Analysis of Variance (ANOVA) was performed to compare CFUs between the two groups and at two different locations. A total of 20 participants were randomized, 10 in each group were allocated and were analysed.

Table 1 displays the baseline demographics and the clinical characteristics of both the groups. The mean age of the participants in the chlorhexidine group and the herbal group was 44.6 years and 43.3 years respectively. Males accounted for 75% of the total participants. The mean plaque index was 2.025 and 2.05 for the chlorhexidine group and the herbal group respectively. No statistically significant differences were observed for any of the above-mentioned variables for the two groups.

	Chlorhexidine Group	Herbal Group	Significance of difference
Age	44.6	43.3	NS
Males/Females	8/2	7/3	NS
No of Teeth	28.8	28.9	NS
Plaque Index	2.025	2.05	NS

Table 1: Baseline demographics and clinical characteristics of both groups.

Table 2 shows the mean CFUs for both the groups and at both the locations. The same has been illustrated in figure 3. The analysis revealed that 0.2% CHX pre-procedural mouthrinse showed a greater reduction of CFUs at both the locations as compared to the herbal pre-procedural mouthrinse (the difference being statistically highly significant; p-value < 0.0001). The number of CFUs were higher at the patient’s chest location as compared to the doctor’s chest location (statistically highly significant differences; p-value < 0.001).

	Herbal group		Chlorhexidine group	
	Doctor chest	Patient chest	Doctor chest	Patient chest
MEAN	49.90	172.50	16.70	75.00
SD	12.25	31.20	12.38	31.62
p-value	<.0001***		<.0001***	
p-value between Herbal group vs. Chlorhexidine group				
	Doctor chest vs. Patient chest		Doctor chest vs. Patient chest	
	0.0001**		<.0001***	

Table 2: Mean CFUs for both groups and at both locations.

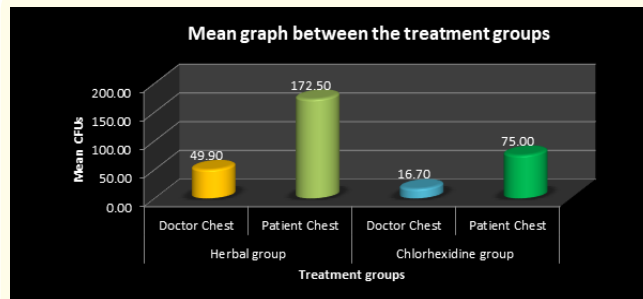


Figure 3: Graph showing mean values of CFUs for the two groups, at two different locations

Thus 0.2% CHX has shown to be more effective in reducing the number of CFUs on the blood agar plate compared to the herbal mouthrinse when used as a pre-procedural mouthrinse 10 minutes prior to scaling in chronic periodontitis patients.

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 [8]. 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.

Chlorhexidine is a bisbiguanide molecule that binds strongly to hydroxyapatite, the organic pellicle of tooth, oral mucosa, salivary proteins and bacteria. Chlorhexidine 0.2% has been demonstrated as being clinically efficacious in inhibition of supragingival plaque formation by Loe Schiott, *et al.* [24] Addy, *et al.* [25] and Santos, *et al.* [26] It has a broad spectrum of antimicrobial activity against gram positive organisms, gram negative organisms, yeasts, dermatophytes and some lipophilic viruses [9,26,27]. Apart from its broad antimicrobial properties, it has a good substantivity. Due to these favourable properties, chlorhexidine is recognized as the gold standard for chemical plaque control. On the other hand, herbal mouthwashes inspite of having excellent antimicrobial properties as suggested by various authors, have little body of evidence pertaining to the efficacy of these mouthwashes as pre-procedural rinse for reduction of aerosol contamination. Thus, the present study was designed to compare the efficacy of a pre-procedural mouthrinsing with a herbal mouthwash with that of 0.2% chlorhexidine mouthwash in reducing the microbial aerosol contamination.

In the present study, blood agar plates were used to collect the airborne microorganisms as it is considered to be a valid non-selective culture medium for culturing airborne microorganisms. When an airborne microorganism settles and grows on the culture medium, it forms colonies which are then counted as colony forming units(CFUs) [28].

Results of the present study indicate that when 10 ml of 0.2% chlorhexidine is used as a pre-procedural rinse for 60 seconds, 10 minutes before ultrasonic scaling, fewer CFUs developed than when the same quantity of herbal mouthwash for the same time was used as a pre-procedural rinse. Purohit, *et al.* [29] observed that pre-procedural rinsing with 0.12% chlorhexidine gluconate significantly reduced the colony forming units (CFU) than without rinsing. Logothetis, *et al.* [27] in 1995 compared the efficacy of chlorhexidine, essential oils and water on the reduction of aerosolized microbes. The results indicated that higher reduction in bacterial counts was achieved by the usage of chlorhexidine mouthrinse. Apart from chlorhexidine, other mouthwashes containing herbal products which have anti plaque efficacies are also being marketed. AM Khalessi, *et al.* [30] in 2004 demonstrated the efficacy of herbal mouth wash in controlling the plaque formation.

The results of the present study are in line with a similar study conducted by Gupta, *et al.* [8] in 2014 who compared the efficacy of chlorhexidine, a herbal mouthwash and water as pre-procedural rinse in the reduction of aerosol contamination.

However, Rani, *et al.* [31] in 2014, did not find any statistically significant differences in the reduction of microbial aerosols between the two groups i.e. chlorhexidine group and a herbal group.

The present study indicated that both the dentist and the patients were exposed to high amount of microbial aerosols produced by ultrasonic scaling. Higher number of colony forming units were observed at the patient's chest location as compared to the doctor's chest location. Bentley, *et al.* [32] observed that the larger salivary droplets generated during dental procedures settle rapidly from the air with heavy contamination on the patient's chest.

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 mouth-rinsing with an antimicrobial mouthwash as an additional barrier to minimize the risk of cross-contamination during ultrasonic scaling. The results also suggest that 0.2% CHX preprocedural mouthrinse is more effective than herbal mouthrinse in reducing aerosol contamination during use of ultrasonic scaling and should be used in dental practice.

Conclusions

The study suggests that 10 ml of 0.2% chlorhexidine when used 10 minutes prior to ultrasonic scaling is more potent in reducing the aerosol contamination as compared to the herbal mouthwash. Also, the patient's chest location was more exposed to the microbial aerosols as compared to the doctor's chest location, which necessitates the usage of preventive methods to reduce the cross contamination in a dental practice.

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Conflict of Interest

No conflict of interest exists.

Bibliography

1. Acharya Shashidhar, *et al.* "Aerosol contamination in a rural university dental clinic in south India". *International Journal of Infection Control* 6. 1 (2010): 003-010.
2. Hinds WC. "Aerosol technology: Properties, behavior, and measurement of airborne particles". *New York: Wiley* 6 (1982).
3. Miller RL. "Generation of airborne infection. by high speed dental equipment". *The Journal of the American Society for Preventive Dentistry* 6.3 (1976): 14-17.
4. Basu MK, *et al.* "A survey of aerosolrelated symptoms in dental hygienists". *The Journal of the Society of Occupational Medicine* 38.1-2 (1988): 23-25.
5. Davies K, *et al.* "Seroepidemiological study of respiratory virus infections among dental surgeons". *British Dental Journal* 176.7 (1994): 262-265.
6. Mikitka D, *et al.* "Tuberculosis infection in US air force dentists". *American Journal of Dentistry* 8.1 (1995): 33-36.
7. Reinthaler F, *et al.* "Serological examinations for antibodies against Legionella species in dental personnel". *Journal of Dental Research* 67.6 (1988): 942-943.
8. Gupta G, *et al.* "Efficacy of preprocedural mouth rinsing in reducing aerosol contamination produced by ultrasonic scaler: a pilot study". *Journal of Periodontology* 84.4 (2014): 562-568.
9. Reddy S, *et al.* "Efficacy of 0.2% tempered chlorhexidine as a pre-procedural mouth rinse: A clinical study". *Journal of Indian Society of Periodontology* 16.2 (2012): 213-217.
10. Konig J, *et al.* "Antiplaque effect of tempered 0.2% chlorhexidine rinse: An in vivo study". *Journal of Clinical Periodontology* 29.3 (2002): 207-210.
11. Williams GH, *et al.* "Laminar Air Purge of Microorganisms in Dental Aerosols: Prophylactic Procedures with the Ultrasonic Scaler". *Journal of Dental Research* 49.6 (1970): 1498-1504.
12. Litsky BY, *et al.* "Use of an antimicrobial mouthwash to minimize the bacterial aerosol contamination generated by the high-speed drill". *Oral Surgery, Oral Medicine, Oral Pathology* 29.1 (1970): 25-30.
13. Worrall SF, *et al.* "Methods of reducing bacterial contamination of the atmosphere arising from use of an air-polisher". *British Dental Journal* 163.4 (1987): 118-119.
14. Glenwright HD, *et al.* "Atmospheric contamination during use of an air polisher". *British Dental Journal* 159 (1985): 294-297.
15. Weeks LM. "Clinical evaluation of the Prophy-Jet as an instrument for routine removal of tooth stain and plaque". *Journal of Periodontology* 55.8 (1984): 486-488.
16. Orton GS. "Clinical use of an air-powder abrasive system". *Dental Hygiene (Chic)* 61.11 (1987): 513-518.

17. Lyle D. "The role of pharmacotherapeutics in the reduction of plaque and gingivitis". *The Journal of Practical Hygiene* 6.9 (2000): 46-50.
18. Gomes Carlos Eduardo Bezerra, et al. "Clinical effect of mouthwash containing *Anacardium occidentale* Linn. on plaque and gingivitis control: A randomized controlled trial". *Indian Journal of Dental Research* 27.4 (2016): 364-369.
19. Darout Ismail Abbas. "Identification and quantification of some potentially antimicrobial anionic components in miswak extract". *Indian Journal of Pharmacology* 32.1 (2000): 11-14.
20. Firas A. "In vitro antimicrobial activity of *Salvadora persica* L. Extracts against some isolated oral pathogens in Iraq". *Turkish Journal of Biology* 32 (2008): 57-62.
21. T Nalina ZHA Rahim. "The crude aqueous extract of piper betel L and its antibacterial effect towards streptococcus mutants". *American Journal of Biochemistry and Biotechnology* 3.1 (2007): 10-15.
22. KM Elizabeth. "Antimicrobial activity of *Terminalia bellerica*". *Indian Journal of Clinical Biochemistry* 20.2 (2005): 150-153.
23. Sreenivasan P. "In vitro antibacterial activity of some plant essential oils". *BMC Complementary and Alternative Medicine* 39.6 (2006): 1-8.
24. Loe H., et al. "Two years oral use of chlorhexidine in man. I. General design and clinical effects". *Journal of Periodontal Research* 11.3 (1976): 135-144.
25. Addy M and Moran JM. "Clinical indications for use of chemical plaque control: Chlorhexidine formulations". *Periodontology* 15 (1997): 52-54.
26. Santos A. "Evidence-based control of plaque and gingivitis". *Journal of Clinical Periodontology* 30.5 (2003): 13-36.
27. Logothetis DD and Martinez-Welles JM. "Reducing bacterial aerosol contamination with a chlorhexidine gluconate pre-rinse". *The Journal of the American Dental Association* 126.12 (1995): 1634-1639.
28. Harrel SK and Molinari J. "Aerosols and splatter in dentistry: a brief review of the literature and infection control implications". *The Journal of the American Dental Association* 135.4 (2004): 429-437.
29. Purohit B., et al. "Efficacy of preprocedural rinsing in reducing aerosol contamination during dental procedures". *Journal of Infection Prevention* 10.6 (2009): 191-193.
30. AM Khalessi, et al. "An in vivo study of the plaque control efficacy of *Persica*: a commercially available herbal mouthwash containing extracts of *Salvadora persica*". *International Dental Journal* 54.5 (2004): 279-283.
31. Rani KR, et al. "Chemical vs. herbal formulations as preprocedural mouth rinses to combat aerosol production: A randomized controlled study". *Journal of Oral Research and Review* 6.1 (2014): 9-13.
32. Bentley CD, et al. "Evaluating spatter and aerosol contamination during dental procedures". *Journal of the American Dental Association* 125.5 (1994): 579-584.

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