Original Article

DOI: 10.7860/JCDR/2023/62226.18122

Diluted Home Bleach as a Preprocedural Mouthrinse Prior to Ultrasonic Scaling: A Non Randomised Clinical Trial

Dentistry Section

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ABSTRACT

Introduction: The benefit of mouth rinsing with an antiseptic prior to aerosol generating dental procedures has been reported and widely accepted. Chlorhexidine (CHX), the widely employed antiseptic mouthrinse is not without side-effects. Diluted home bleach (sodium hypochlorite) has been in use as an antiseptic mouthrinse and its role in plaque control is well documented. It is safe, less expensive and readily available.

Aim: To compare the aerosol microbial load after ultrasonic scaling between three preprocedural rinses namely 0.1% sodium hypochlorite (diluted home bleach), 0.2% CHX and distilled water.

Materials and Methods: A non randomised clinical trial was conducted in the Postgraduate Clinic, Department of Periodontics, Government Dental College, Kottayam and Department of Microbiology, Government Medical College, Kottayam, Kerala, India, from April 2021 to September 2021. Study included sixty systemically healthy adults {Full-mouth Plaque Score (FMPS) and Full-mouth Bleeding Score (FMBS) >25%, with atleast one periodontal pocket >4 mm in each quadrant} who were divided into three Groups (A, B, C) of 20 each receiving diluted home bleach, CHX or distilled water, respectively as preprocedural rinse. Subjects rinsed 15 mL of solution for 30 seconds, 10 minutes prior to ultrasonic scaling. Blood agar plates kept at patient's chest and doctor's chest locations to collect aerosols were incubated for 48 hours and microbial Colony Forming Units (CFUs) counted. Analysis of Variance (ANOVA) was used to compare the amount of CFUs at the two sites between three groups. Independent t-tests were used to compare the intragroup CFU counts between two sites.

Results: The mean age of group A, group B and group C was 45.15±7.01 years, 41.9±9.96 years and 43.2±7.93 years, respectively. There were 13 males and 7 females, 7 males and 13 females and, 11 males and 9 females in group A, group B and group C, respectively. There were more CFUs in patient's chest location sample compared to doctor's chest location in all three mouthrinse groups. For Sodium hypochlorite (NaOCl), mean difference was 43.850 (95% CI 15.2-72.4), for CHX 45.800 (95% CI 25.9-65.6), for distilled water 56.650 (95 % CI 20.2-93.0), respectively which were statistically significant (p-value <0.05). The home bleach and CHX groups showed significantly fewer CFUs than distilled water on both locations. On comparison with CHX, diluted home bleach demonstrated fewer CFUs, but this difference was not statistically significant.

Conclusion: Diluted home bleach and CHX preprocedural rinses were comparable in terms of CFU counts in dental aerosols generated during ultrasonic scaling. Diluted home bleach mouthrinse is safe, economical and readily available in every household.

Keywords: Bioaerosol, Household bleach, Periodontal treatment, Sodium hypochlorite

INTRODUCTION

One of the major concerns in the dental environment is the generation of contaminated aerosol and splatter. The use of an ultrasonic scaler and a high-speed hand piece produces the most intense aerosol and splatter, although many other dental treatments have the potential to produce contaminated aerosols. Different methods are used to intervene aerosol contamination including the use of personal protective equipment, high efficiency particulate air room filters, ultraviolet treatment of ventilation system, use of high-volume evacuator and preprocedural rinsing with an antiseptic mouthwash [1]. Preprocedural rinsing is highly effective in reducing microorganisms in aerosol and numerous agents have been tried to this end [2]. Dental professionals need to wear additional respiratory protection, gowns, eye protection, and comply with a range of additional recommended procedures for infection control during the procedures [3]. Aerosol Generating Procedures (AGPs) particularly drilling, ultrasonic scaling, air polishing, and use of air/water syringes can potentially aerosolise respiratory secretions in dental operatory [4]. Preprocedural mouth rinsing with an antiseptic has been one of the strategies recommended to minimise the risk of aerosol contamination [5]. Preprocedural rinsing is highly effective in reducing the aerosol microbial load and several agents including CHX, Povidone Iodine (PI), essential oil, tea tree oil, cetyl pyridium chloride and chlorine dioxide have been employed to this effect [6,7].

Chlorhexidine, the gold standard antiplaque agent is also the most widely used preprocedural rinse as it significantly reduces the viable microbial load in aerosols [8,9]. The commercially available mouthrinses have important adverse effects ranging from altered taste perception to anaphylaxis. Owing to its antiseptic properties, the popular endodontic irrigant, NaOCl, is designated as a mouthrinse by American Dental Association Council on Dental Therapeutics [10]. NaOCl occurs naturally in human neutrophils, monocytes and macrophages [11]. It is not allergic, mutagenic, carcinogenic, or teratogenic, and has a century old history of safety [12]. It is widely used as an antiseptic in hospital wards, food processing industry and dental clinics owing to its high degree of safety. Household bleach containing NaOCl in concentrations of 5-6% is inexpensively accessible throughout the world.

Periodontitis is highly prevalent and periodontal therapy is expensive. There is a renewed interest in low-cost antiseptics in periodontics as an adjunct to mechanical therapy and in self-care in pursuit of affordable public health and preventive initiatives particularly in resource poor settings [13]. Inclusion of twice weekly oral rinsing with diluted home bleach in patient's self-care was found to be more effective in reducing bleeding scores [14]. However, the use of

NaOCl as preprocedural mouthrinse has not been reported yet. In order to compare NaOCl's antibacterial effects to CHX, the present study attempts to evaluate the efficacy of NaOCl as a preprocedural mouthrinse prior to ultrasonic scaling.

MATERIALS AND METHODS

This non randomised clinical trial was conducted in the Postgraduate Clinic, Department of Periodontics, Government Dental College, Kottayam and Department of Microbiology, Government Medical College, Kottayam from 1st April 2021 to 30th September 2021. The study was reviewed and approved by the Institutional Ethical Committee and Review Board, Government Dental College, Kottayam, Kerala, India. (IEC/M/17/2019/DCK). Written informed consent was taken from all subjects.

Inclusion criteria: Subjects of age between 18-55 years, having a minimum of 20 permanent teeth, FMBS and FMPS >25% [15], Probing Pocket Depth (PPD) ≥4 mm, in atleast one site per quadrant and systemically healthy individuals were included in the study.

Exclusion criteria: Subjects with definite contraindication for the use of ultrasonic scaling device, history of systemic or topical antibiotics use within the last three months, history of scaling or mouth wash use within the past three months, pregnant women and current smokers were excluded from the study.

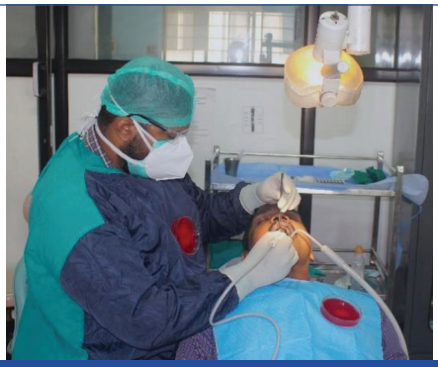
Sample size calculation: Sample size was calculated using GPower 3.1.9.7 software with the following settings-family of F-tests, statistical test- ANOVA with repeated measures between factors. Effect size of 0.35, alpha less than 0.05 and power of 0.8 [16]. The calculated sample size was 57. For convenience, rounded off to 60 (20 subjects per group). Sixty patients satisfying the inclusion criteria thus, enrolled in the study from 1st April 2021 to 30th September 2021.

Study Procedure

After baseline assessment of FMBS, FMPS, PPD participants were divided into three groups of 20 based on the preprocedural mouthrinse received as:

- Group A- 0.1% NaOCl (The Clorox Company, CA 94612, USA) [10,17].
- Group B- 0.2% CHX (Hexidine: ICPA Health Products Ltd. India).
- Group C- Distilled water.

For the study purpose, 0.1% NaOCl is prepared by adding one teaspoon (5 mL) of 8.25% of home bleach (Clorox) to 250 mL of water. A fresh NaOCl working solution was made every day and stored in a dark disposable bottle. Subjects used 15 mL of designated mouthrinse for 30 seconds and, 10 minutes prior to scaling. Sheep blood agar plates (Biomerieux India Pvt., Ltd., Mumbai) were used to collect the aerosols generated during the procedure. They were attached using adhesive tapes to two predetermined locations: the patient's chest area and the doctor's chest area [Table/Fig-1]. As the first patient of each day, ultrasound scaling was performed on all patients in the same closed operating room. For the research, only one case was completed each day. All of the surfaces were cleansed and sterilised with 70% isopropyl alcohol prior to the process. Both the operator and the patient were wearing personal safety equipment. Distilled water was used as coolant for scaling; it was changed for every case. Furthermore, each day, the water line was flushed for one minute before being used in the patients. Subjects used 15 mL of designated mouthrinse for 30 secods 10 minutes prior to scaling. After placing agar plates open at prementioned sites, ultrasonic scaling was done for 20 minutes. Power setting, frequency, and water flow were standardised for all the cases as per manufacturer's recommendation. Then, the plates were closed, sealed, labelled, and immediately incubated at 37°C for 48 hours. A colony counter (Labtronics microprocessor colony counter) was used for the CFU count.



[Table/Fig-1]: Agar plates location using double adhesive tape on patient's chest area and doctor's chest area.

STATISTICAL ANALYSIS

Statistical analysis was done using Statistical Package for the Social Sciences (SPSS) software version 16.0 (SPSS Inc., Chicago, IL. USA). ANOVA test was employed to compare the amount of CFUs at the two sites between groups. Using an independent t-test, the quantity of CFUs at the two sites was compared within each group.

RESULTS

The mean age of group A (13 males and 7 females), group B (7 males and 13 females) and group C (11 males and 9 females) were 45.15±7.01, 41.9±9.96 and 43.2±7.93 years, respectively. FMPS, FMBS and PPD were comparable at baseline between the groups [Table/Fig-2]. The post scaling CFU counts were different among the groups with the lowest in group A and highest in group C. A similar pattern in CFU counts was seen in agar plates from the doctor's chest and patient's chest locations. The difference in mean CFU counts between group A and C as well as between group B and C were statistically significant (p-value <0.05). But the difference in mean CFU count between group A and B were not statistically significant [Table/Fig-3,4]. On comparing the mean CFU counts between the two agar plate locations, patient's chest area showed a higher count which was statistically significant (p-value <0.05) [Table/Fig-5].

Parameters	Mean±SD			p-value
	Group A (n=20)	Group B (n=20)	Group C (n=20)	
FMPS	54.4±10.30	57.1+9.20	57.6+8.37	0.087
FMBS	53.0±9.38	60.8+9.76	59.9+8.86	0.210
PPD (mm)	3.4±0.58	3.3+0.52	3.3+0.49	0.711

[Table/Fig-2]: Comparison of baseline clinical characteristics between three groups.
FMPS: Full mouth plaque score; FMBS: Full mouth bleeding score; PPD: Probing pocket depth; SD: Standard deviation
One-way ANOVA and posthoc Bonferroni correction used to calculate p-value

Location	Mean±SD			p-value	Posthoc comparison			
	Group A	Group B	Group C		Group	Mean difference	SE	p-value
Doctor's chest area	103.65+41.016	108.85+33.22	186.70+55.83	**<0.001**	A-B	-5.200	14.028	1.000
					A-C	-83.05	14.028	**<0.001**
					B-C	-77.85	14.028	**<0.001**

[Table/Fig-3]: Comparison of the number of colonies forming units between three groups at doctor's chest area.
SE: Standard error; One-way ANOVA and posthoc Bonferroni correction used to calculate p-value. The p-value in bold font indicates statistically significant values

Location	Mean±SD			p-value	Posthoc comparison			
	Group A	Group B	Group C		Group	Mean difference	SE	p-value
Patient's chest area	147.50+50.8	154.65+30.93	243.35+61.43	**<0.001**	A-B	-7.15	15.61	1.000
					A-C	-95.85	15.61	**<0.001**
					B-C	-88.70	15.61	**<0.001**

[Table/Fig-4]: Comparison of the number of colonies forming units between three groups at patient's chest area.
One-way ANOVA and posthoc Bonferroni correction used to calculate p-value. The p-value in bold font indicates statistically significant values

Group	Mean difference	SE of difference	95% CI	p-value
Sodium hypochlorite	43.850	14.60	15.2-72.4	**0.024**
Chlorhexidine	45.800	10.15	25.9-65.6	**<0.001**
Water	56.650	18.562	20.2-93.0	**0.035**

[Table/Fig-5]: Comparison between the number of colonies forming units at two locations among the three groups.
CI: Confidence interval; Independent sample t-test used to calculate p-value. The p-value in bold font indicates statistically significant values

DISCUSSION

The post scaling CFU counts were lowest in 0.1% NaOCl group and highest in distilled water group. There was a statistically significant difference between the three groups in the number of CFUs formed on blood agar plates at both locations with highest number of CFUs seen in the patient's chest area than the doctor's chest area. Hence, independent of the type of mouthrinse employed, the distance from the aerosol source does matter in the aerosol microbial load in dental settings with more CFUs in location close to the mouth compared to distant locations. This finding is in accordance with previous report [18].

As the patients in the three groups had similar oral hygiene and periodontal parameters (FMPS, FMBS and PPD) at baseline, this difference in the number of CFUs can be attributed to the effect of the mouthrinse used. The lowest number of mean CFUs was seen with sodium hypochlorite group, followed by the CHX group, and the highest with the distilled water group in agar plates on both locations. This observation in the diluted home bleach group could be due to the excellent broad-spectrum antimicrobial and antiviral properties of NaOCl [19]. The mean difference in CFUs between the NaOCl and water groups, as well as the CHX and water groups, was found to be statistically significant (p-value <0.05). There was no statistically significant difference in the number of CFUs between NaOCl group and CHX group. However, the mean CFU count in NaOCl group was less compared to CHX group in terms of numbers. The small sample size could be the reason why statistical significance was not obtained for this difference. Hence, based on the observations from this study it appears that the antimicrobial properties of CHX and NaOCl are comparable when used as preprocedural mouthrinse.

Two locations, namely doctor's chest area and patient's chest area, was employed for aerosol collection in a previous study by the Paul B et al., [18]. These locations are important due to the proximity to the operator, dental assistant, dental armamentarium and the patient himself/herself. A higher number of mean CFUs was observed in the patient's chest area as compared to the doctor's chest area, consistently in all the three groups which was statistically significant. This shows that distance from the oral source is an important determinant in the presence of microorganisms in dental aerosols. As distance from the mouth increases, the aerosols contain less microbes. Similar finding was reported by Paul B et al., [18]. He concluded that there was significant difference in the number of CFUs between both agar plate locations in all mouthrinse groups and the patients chest location which was closer to the mouth demonstrated more CFUs which was statistically significant [18].

In the literature, no standardised protocol could be found for the preprocedural rinsing as there is variation in rinsing time, quantity of rinse and the interval between rinsing and the AGPs in different reports [7,20]. The present study assessed FMBS, FMPS and PPD at baseline as opposed to gingival index, plaque index, and PPD in other similar studies. FMPS and FMBS are clinical indices that were suggested to indicate gingival health. Several researchers have used various culture media for CFU collection, culture, and counting, with blood agar plates being the most common choice. However, soya agar plates and honokiol agar plates have also been reported to be used [20]. The conventional sheep blood agar plates were employed in the current investigation.

Some studies reported additional interventions to reduce aerosol microbial load particularly the use of high-volume evacuation, and irrigation using ozone with varying success [21-23]. The present study did not assess the use of such additional aids instead the standard chair side suction unit was employed for AGPs in all subjects. Few other studies utilised Polymerase Chain Reaction (PCR) and checkerboard Deoxyribose Nucleic Acid (DNA)-DNA hybridisation techniques to estimate aerosol microbial load after AGP [24,25]. Dilute form of NaOCl is suggested as a low-cost antiseptic for periodontal treatment [13]. NaOCl does not corrode intraoral hard surfaces such as teeth and titanium implants. It was substantive enough to remain for 24 hours in the oral cavity [13]. Gonzalez S et al., reported that a significant reduction in bleeding on probing, even in deep unscaled pockets was noticed on oral rinsing with dilute bleach (0.25% NaOCl) twice-weekly [26]. Diluted home bleach mouthrinse is economical, can be prepared at home and devoid of the side-effects of CHX. Therefore, NaOCl can potentially be a valuable antiseptic in periodontal self-care [19].

Limitation(s)

The present study's limitations include the lack of randomisation in patient allocation and the lack of use of specialised culture techniques for bacterial identification. Additionally, the inability to maintain a completely sterile clinical environment may be mentioned. More precise microbiologic outcomes, such as species-specific PCR for assessment of aerosol microbial load and microbial identification, should be employed in future investigations. Further, randomised controlled clinical trials with large samples in multiple centres are required to verify this significance.

CONCLUSION(S)

Preprocedural rinsing with an antimicrobial mouthrinse is an effective way to reduce aerosol contamination due to ultrasonic scaling. Diluted home bleach as preprocedural rinse was significantly better than distilled water and has shown comparable effects to CHX on aerosol microbial load. Diluted home bleach mouthrinse can be easily prepared at home and is devoid of the side-effects of CHX. Further research including randomised controlled clinical trials is needed to establish its effectiveness as a preprocedural rinse.

Acknowledgement

Authors would like to thank faculty members of Department of Public Health Dentistry, Government Dental College, Kottayam, Kerala, India.

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PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Dec 15, 2022
- Manual Googling: Feb 11, 2023
- iThenticate Software: Mar 15, 2023 (20%)

ETYMOLOGY: Author Origin

EMENDATIONS: 7

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. Yes

Date of Submission: **Dec 13, 2022**
Date of Peer Review: **Jan 18, 2023**
Date of Acceptance: **Mar 16, 2023**
Date of Publishing: **Jun 01, 2023**