Original Article

Comparison of intraoral distribution of two commercially available chlorhexidine mouthrinses with and without alcohol at three different rinsing periods

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Abstract

Objectives: This study compared the intraoral distribution of 0.1% chlorhexidine with alcohol (CHX+Alc) and 0.2% chlorhexidine without alcohol (CHX-Alc) with shorter rinsing times (10s,20s,30s) following a 72h non brushing period. **Materials and Methods:** This study was designed as a single blind, randomized two group parallel experiment with a total of 30(15male,15 female) dental students. To disclose the plaque, erythrosine-containing disclosing agent was added to both the mouthrinses. Group I (0.1% CHX+Alc) & Group II (0.2% CHX-Alc) were asked to rinse with respective mouthrinse for cumulative periods of 10,20 and 30s, following which plaque was scored. **Results:** In Group I, comparison between 10&20, 10&30s was statistically significant but no significance was observed between 20&30s, whereas in Group II, comparison between all the time points were statistically significant. On comparison of plaque scores, plaque scores of both the groups at 10 & 30s sec, show no statistical significance but at 20 seconds was significant (P<0.001).The mean plaque scores of lingual surfaces were lesser in group II whereas in group I lingual surfaces recorded more plaque than the vestibular surfaces. **Conclusions:** Within the limitations of this study, it can be concluded that rinsing for 30 seconds with 0.2% CHX-Alc (Rexidin) is enough for intraoral spread of the mouthrinse whereas rinsing with 0.1% CHX+Alc(Eludril) for achieves the same in 20 seconds, for effective plaque inhibition, both of which will have a positive influence on patient compliance.

Key words: *Chlorhexidine, alcohol, rinsing time, plaque*

INTRODUCTION

The role of oral biofilm in causing and perpetuating periodontal disease is well established; therefore, prevention of plaque accumulation is the cornerstone of periodontal therapy. This can be achieved by plaque control, both mechanical and chemical. Mechanical plaque control, although appears simple, cannot be properly practiced by most individuals. Limitations of the brushing techniques is the inability to access interproximal areas and the need for additional aids like floss or an interdental brush to prevent plaque accumulation.[1] A systematic review of the effectiveness of self-performed mechanical plaque removal in adults with gingivitis concluded that the quality of the mechanical plaque control was not sufficiently effective in reducing gingivitis.[2] Moreover, mechanical plaque control concentrates primarily on the tooth surfaces, whereas microorganisms that accumulate on multiple soft tissue surfaces also serve as a source of bacteria for the colonization of tooth surfaces.[3]

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Introduction of chemical agents have taken care of the drawbacks of mechanical plaque control. The most

popular agent till date in terms of efficacy and safety is Chlorhexidine (CHX). CHX is a water-soluble, cationic biguanide that binds to the negatively charged bacterial cell wall, altering the bacterial cell osmotic equilibrium. At low concentrations, CHX affects membrane integrity, but at high concentrations, cytoplasmic contents precipitate, resulting in cell death. It has a broad activity against gram-positive and gram-negative bacteria, facultative anaerobes and aerobes, yeast, and some lipid-enveloped viruses, including human immunodeficiency virus.[4] CHX is commercially available at a variety of concentrations (0.1%, 0.12% and 0.2%) and formulations (with and without alcohol).

Although it contains alcohol, which is beneficial as a dissolvent as well as an antiseptic, it can cause pain and can be carcinogenic, and cannot be used in patients where alcohol is unacceptable or contraindicated. The advent of alcohol free mouthrinses has overcome these disadvantages and many studies have shown their efficacy and lack of side effects.

A number of studies have been performed on the rinsing time and effective plaque inhibition of CHX mouthrinses. Keijser *et al,* [5] showed that plaque inhibition by rinsing 15mL of 0.12% CHX for 30s was comparable to rinsing with 10mL of 0.2% for 60s. In another study,[6] no significant difference was observed in the level of plaque, irrespective of whether the subjects rinsed for 15, 30, or 60s with 0.2% CHX. A recent study by Van Strydonck *et al,* [7] found that rinsing with 0.12% CHX (alcohol free) for 30s was not significantly different from rinsing with 0.2% CHX (alcohol base) for 60s. A study on optimal rinsing time for intraoral distribution of erythrosine-containing mouthwash showed that rinsing for 30s was sufficient for all plaque covered surfaces of the dentition to come in contact with the mouth wash.[8]

CHX is prescribed for both short- term and long- term use. The drawbacks of CHX include tooth staining and alteration in the taste perception, preventing long-term use. It is clear that better patient compliance is possible with shorter rinsing times. We set forth to determine whether rinsing times shorter than 30s could achieve adequate plaque inhibition by evaluating the intraoral spread of two commercially available CHX mouth rinses – 0.1% CHX with alcohol(CHX+Alc) versus 0.2% CHX without alcohol(CHX-Alc).

MATERIALS AND METHODS

This study was designed as a single blind, randomized two group parallel experiment using two different mouth rinses. A total of 30 dental students (15male and 15female), who attended the Department of Periodontics, Thai Moogambigai Dental College and Hospital, were recruited for the study. The study was planned with a sample size of 15 subjects, with a true difference of 0.06 and a standard deviation of 0.07 in the plaque index scale (Turesky modification of the Quigley–Hein index) with 80% power and with an α error of 0.05 that could be observed. All the subjects were appraised about the product, and the purpose of the study, and oral instructions were given prior to the experimental period. Students without a minimum of five evaluable teeth per quadrant, with fixed or removable prostheses, extensive carious lesions, multiple cervical restorations, antibiotic or other medication consumption in the last two months that might interfere with oral hygiene, presence of periodontal problems, adverse reaction to CHX and the ones taking special diets were excluded from the study. The Ethical Committee of our university approved the study and written consent was obtained from all the participants.

In order to disclose the plaque, erythrosine-containing disclosing agent was added to both the mouthrinses. Alcohol-containing 0.1% CHX (Eludril;Win Medicare Pvt. Ltd, India.) was assigned as Group I and alcohol - free 0.2% CHX (Rexidin;Warren, Indoco Remedies Ltd,India.) as Group II. The participants were randomly allocated to Group I and Group II (15 in each group) and advised not to follow any form of plaque control for 72h to allow for free plaque accumulation on all the tooth surfaces. On their subsequent visit, Group I subjects were asked to rinse with 30mL of solution I(as per manufacturer's instructions) for 10 s, following which plaque was scored (Quigley hein plaque index[9] as modified by Turesky *et al.*[10] and further modified by Lobene *et al*[11]). Then, they were asked to rinse for another 10 s(total rinsing time of 20s), followed by plaque measurements. This was repeated for another 10s (total rinsing time of 30s) and the new plaque scores were noted. The Group II participants were asked to rinse with 10mL of solution II (as per manufacturer's guidelines) for three consecutive periods of 10s (rinsing time of 10, 20 and 30s) and plaque scores were calculated at the end of each rinsing session. At the end of the experiment, professional cleaning was done on all subjects to remove the remaining plaque and disclosing agent.

Statistical analysis

Mean plaque scores were calculated and was used as

the primary outcome variable. Student's t-tests were performed to compare all the rinsing sessions within each group and also to compare the various rinsing times between the groups. Explorative analysis was carried out to calculate the mean plaque scores for the upper and lower jaws and the different tooth surfaces for both the groups. However, no statistical interpretation regarding significance was evaluated.

RESULTS

Table 1 shows the comparison of mean values between the different time points in Group I (0.1% CHX+Alc). Comparison between 10 and 20 and,10 and 30s are statistically significant ($P<$ 0.001), but no significance was observed between 20 and 30s, whereas in Group II (0.2% CHX- Alc), comparison between all the time points are statistically significant ($P<0.001$) [Table 2]. In Table 3, comparing plaque scores of both the groups at 10s, shows no statistical significance, but comparison at 20s [Table 4] between the two groups is significant ($P<0.001$). However, at 30s [Table 5], no statistical significance was noted. Mean plaque scores of the lingual surfaces are lesser in Group II, whereas in Group I, the lingual surfaces recorded more plaque than the vestibular surfaces [Tables 6 and7].

Table 1: Mean overall plaque scores between different time points (Group I)

Time points	N	Mean	*P* value*
10 s	15	0.81 (0.61)	<0.001
20 s	15	2.25 (0.74)	
10 s	15	0.81 (0.61)	<0.001
30 s	15	2.55 (0.55)	
20 s	15	2.25 (0.74)	0.218^{+}
30 s	15	2.55 (0.55)	

*Standard deviations are in parentheses, *Independent t-test (P<0.001), †Non-significant*

Table 2: Mean overall plaque scores between different time points (Group II)

Time points	N	Mean	*P* value*
10 s	15	0.81 (0.34)	<0.001
20 s	15	1.49 (0.44)	
10 s	15	0.81 (0.34)	<0.001
30 s	15	2.65 (0.37)	
20 s	15	1.49 (0.44)	<0.001
30 s	15	2.65 (0.37)	

*Standard deviations are in parentheses, *Independent t-test (P<0.001)*

Table 3: Mean overall plaque scores between Group I and Group II at 10s

Group	N	Mean	*P* value*
I	15	0.81 (0.61)	0.999^{+}
II	15	0.81 (0.34)	

*Standard deviations are in parentheses, *Independent t-test (P<0.001), †Non-significant*

Table 4: Mean overall plaque scores between Group I and Group II at 20s

Group	N	Mean	*P* value*
I	15	2.25 (0.74)	<0.001
II	15	1.49 (0.44)	

*Standard deviations are in parentheses, *Independent t-test (P<0.001)*

Table 5: Mean overall plaque scores between Group I and Group II at 30s

Group	N	Mean	*P* value*
I	15	2.55 (0.55)	0.564^{+}
II	15	2.65 (0.37)	

*Standard deviations are in parentheses, *Independent t-test (P<0.001), †Non-significant*

Table 6: Mean plaque scores of the upper and lower jaw and vestibular and lingual surfaces (Group II)

Rinsing time	Upper jaw	Lower jaw	Vestibular surfaces	Lingual surfaces
10	0.85 (0.70)	0.84 (0.62)	0.94 (0.50)	0.72 (0.82)
20	1.74 (0.86)	1.89 (0.69)	1.87 (0.82)	1.81 (0.80)
30	2.3 (0.83)	2.50 (0.42)	2.55 (0.57)	2.36 (0.94)

Standard deviations are in parentheses

Table 7: Mean plaque scores of the upper and lower jaws and vestibular and lingual surfaces (Group I)

Rinsing time	Upper jaw	Lower jaw	Vestibular surfaces	Lingual surfaces
10	0.81 (0.43)	0.89 (0.41)	0.83 (0.44)	0.89 (0.42)
20	1.70 (0.44)	1.91 (0.56)	1.73 (0.51)	1.83 (0.47)
30	2.53 (0.54)	2.78 (0.47)	2.65 (0.47)	2.66 (0.49)

Standard deviations are in parentheses

DISCUSSION

CHX is the leading antiplaque agent till date, because of its many ideal properties, and its efficacy has been proven by many studies.[12,-13] It still remains the gold standard, and rinsing with 0.2% for 60s twice daily has shown to prevent inflammation of the gums and tooth decay.[14] Cosmetic problems such as tooth staining and taste perturbation precludes long-term use, but the newer formulations at 0.1 and 0.12% concentrations have overcome these drawbacks. Moreover, for prolonged use, shorter rinsing times lesser than 60s are more likely to gain patient compliance. Van der Weijden *et al,*[6] tested 15, 30,and 60s rinsing times on the level of plaque over a 72h non-brushing period, and no significant difference was observed in plaque levels in all the three periods.

The intention of our study was to compare the intraoral distribution of 0.1% CHX with alcohol with 0.2% CHX without alcohol at shorter rinsing times (10, 20 and 30s). Erythrosine was chosen for this study as it easily discloses plaque. Moreover, it has FDA approval and is readily available.[15] The primary outcome measure was intraoral distribution of both the mouthrinses at shorter rinsing times and the secondary outcome measure included comparison of the spread of mouthrinse on the vestibular and oral tooth surfaces.

The results show that intraoral distribution of both the groups at 10 and 30s is comparable but at 20s, it is statistically significant. In Group II (0.2% CHX-Alc), there is a statistically significant difference when the 10s rinsing session was compared with20 and 30s. This suggests that 10s is not sufficient for the mouthrinse to reach all the plaque-covered surfaces. Moreover, it is well understood that subsequent plaque scores obtained after each rinsing session represent a cumulative effect of mouthrinse in the mouth.[8] Although, traditionally, it has been shown that rinsing for 60s with 10mL of 0.2% CHX is effective, our results show that 30s achieves good intraoral spread for plaque inhibition. This result also agrees with the results of Paraskevas *et al.,*[8] who showed that rinsing for 30s is sufficient in order for plaque-covered surfaces of the dentition to come in contact with the mouthrinse. In Group I (0.1% CHX+Alc), no statistical significance was noted between 20 and 30s. Therefore, it is clear that rinsing for 20s was sufficient to disclose the plaque-covered surfaces. Bonesvoll and Germo[16] showed that plaque inhibition by CHX is dose dependent and that similar plaque inhibitions can be achieved with larger volumes of lower concentration solutions. Therefore, it is possible that rinsing a larger volume (30mL) of solution has a better intraoral distribution than 10mL for the same time period. Keijser et al., [5] showed that concentrations of 0.12% CHX appear as effective as 0.2% if the volume of the rinse was increased from 10 to 15mL, giving an 18 mg dose on each occasion. Similarly, we can assume that concentrations of 30 mL of 0.1% CHX with the 15mg dose appear as effective as 0.2%.

The explorative analysis shows that the amount of stained plaque on the lingual surfaces is less when compared with the vestibular surfaces in Group I. Our results are in accordance with older studies,(Ramsey *et al.,*[17], Vander Weijden *et al.,*[18], Claydon *et al.,*[19,20]), which showed the inability of the mouth wash to reach the lingual surfaces. However, in Group I, stained plaque on the lingual surfaces were greater than that on the vestibular surfaces. One possible explanation would be that the increased volume (30mL) of CHX was able to reach the lingual surfaces better than 10 or 15mL.

The addition of alcohol serves many purposes: as a vehicle, as an antiseptic, to stabilize certain active ingredients and also to improve the shelf-life of the product. Concerns linking oral cancer and alcohol-containing mouthrinses are high, although there is not much scientific evidence. The accepted concentration of alcohol content in CHX mouthrinses by theFDA is 11.6%. Although Eludril has 45% alcohol, when diluted to 30mL, it has only 7.4%. Non-alcohol-containing CHX have fewer side-effects, but are less-effective. Data regarding intraoral distribution of alcohol-containing and non-alcohol mouthrinses are unavailable, but one study has shown that both are effective in controlling plaque and reducing gingival inflammation.[21] To the best of our knowledge, this is the first study to have compared the intraoral spread of alcohol and non-alcohol-containing mouthrinses. Our study shows that (CHX+Alc) achieves better intraoral spread at 20 s than (CHX-Alc).

Within the limitations of this study, it can be concluded that rinsing for 30 s with 0.2% CHX- Alc (Rexidin) is enough for intraoral spread of the mouthrinse, whereas rinsing with 0.1% CHX + Alc (Eludril) achieves the same effect in 20s, for effective plaque inhibition, both of which will have a positive influence on patient compliance. However, further studies with a larger sample and a longer study period are required to determine whether this shorter rinsing time will provide effective plaque control over prolonged use.

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