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Comparative Evaluation of Efficacy Of 0.2% Chlorhexidine And 0.12% Chlorhexidine and An Herbal Mouthwash in Reducing Dental Aerosol as A Preprocedural Mouthwash

Dr. Abhisha K[*1], Dr. Nita Syam[2], Dr. Shabeer Ahamed[3], Dr. Lakshmy M[4], Dr. Devipriya[5], Dr. Shimreen K[6]

[1]Post Graduate, Department of Periodontology, Malabar Dental college and Research centre

[2]Professor and Head of the Department, Department of Periodontology, Malabar Dental college and Research centre

[3]Professor, Department of Periodontology, Malabar Dental college and Research centre

[4]Senior Lecturer, Department of Periodontology, Malabar Dental college and Research centre

[5]Senior Lecturer, Department of Periodontology , Malabar Dental college and Research centre

[6]Post graduate, Department of Periodontology , Malabar Dental college and Research centre

***Corresponding Author:**

Dr. Abhisha K

Department of Periodontology, Malabar Dental College and Research Centre, Edappal, Malappuram,Kerala, India.

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ABSTRACT

Aims: The aim of the present study was to assess and compare the efficacy of different pre-procedural mouth rinses in reducing microorganisms in dental aerosols.

Settings and Design:This study was conducted with a total of 40 patients from the department of periodontology, who were randomly assigned into four groups of ten patients each.

Methods and Material: Each group was administered a specific pre-procedural mouth rinse distilled water,0.2% CHX,0.12% CHX, or an herbal mouthwash.Aerosols generated by an ultrasonic scaler were collected at a distance of 12 inches from the patient's mouth onto blood agar plates.These plates were incubated at 37 degrees Celsius for 48 hours, after which CFUs were counted.

Statistical analysis used:Data was analyzed using the One-way Anova test followed by BONFEERONI TEST Posthoc test.

Results: In the present study, 0.2% CHX and 0.12% CHX shows significantly similar amount of reduction in CFUs when used as a preprocedural mouthwash during ultrasonic scaling followed by an herbal mouthwash, respectively.

Conclusions: The findings of the current study shows that usage of pre procedural mouthrinse will reduce the amount of bacterial count in aerosols produced during ultrasonic scaling.The lower concentration of 0.12% chlorhexidine not only maintained optimal clinical results but also enhanced patient compliance.

Keywords: *Bio aerosols,mouth wash,chlorhexidine, herbal mouth wash, CFUs.*

Key Messages:*Usage of mouth wash as a preprocedural mouthrinse will reduce the amount of bioaerosols produced*

1. INTRODUCTION

Humans produce bio-aerosols through talking, breathing, sneezing, or coughing, which may carry infectious pathogens if they are infected.[1,2,3]Aerosols and splatter in dental operatories heighten infection risks for staff and patients, requiring strict infection control measures.[4] Using an antimicrobial preprocedural mouthwash is a simple,cost-effective,and safe method to reduce oral bacteria and lower infection risk during dental procedures.[5]Recommended preprocedural mouthwashes include chlorhexidine gluconate, cetylpyridinium chloride,povidone-iodine,hydrogen peroxide and some herbal formulations for their antimicrobial properties.[6]

This study evaluated and compared the effectiveness of three pre-procedural mouth rinses—0.2% chlorhexidine, 0.12% chlorhexidine, and an herbal mouthwash - in reducing microorganisms in dental aerosols.

2. SUBJECTS AND METHODS:

This research was carried out in vivo within the Department of Periodontology at Malabar Dental College and Research Centre, located in Kerala, India. The study involved a total of 40 patients who sought dental care at the department. Each participant was thoroughly informed about the purpose and procedures of the study, ensuring that their participation was entirely voluntary. Notably, there were no specific criteria regarding age or gender for selecting participants.

Inclusion Criteria: Presence of at least 20 permanent teeth, non-smokers,systemically healthy individuals, four or more sites with a probing depth of 4 mm or greater

Exclusion Criteria: Patients currently taking systemic antibiotics, with a history of oral prophylaxis within the last 3 months, pregnant or lactating women

Materials Used: Ultrasonic scaling device, blood agar plates, PerioGuard mouthwash, Oro Guard mouthwash and Oralife mouthwash

A total of 40 patients were randomly assigned to 4 groups, with 10 patients in each group:

Group 1: rinsed with 10 ml of distilled water (Control group)

Group 2: rinsed with 10 ml of 0.2% chlorhexidine (Oro Guard mouthwash)

Group 3: rinsed with 10 ml of 0.12% chlorhexidine (Perio Guard mouthwash)

Group 4: rinsed with 10 ml of a herbal mouthwash (Oralife mouthwash)

Ten minutes prior to commencing the professional treatment utilizing ultrasonic scalers, patients were instructed to rinse their mouths with 10 ml of the designated mouthrinses for a duration of 60 seconds.

To capture the aerosol generated during the procedure, blood agar plates were used for collecting samples. Two specific and standardized locations within the operatory were chosen for evaluation. The first blood agar plate was strategically placed at the chest area of the patient, positioned 12 inches away from the patient's mouth to effectively monitor any aerosol diffusion. Simultaneously, a second blood agar plate was positioned at the doctor's chest area, also maintaining a distance of 12 inches from the patient's mouth, allowing for a comparative analysis of aerosol exposure in both positions.

Aerosols were carefully collected on blood agar plates over a duration of 30 minutes. To ensure a clear and safe environment, only one patient was treated each day, allowing ample time for the room to clear of any residual aerosols. Scaling was performed using a piezoelectric ultrasonic scaler, complemented by a motorized suction device to effectively manage debris and fluids. Following the collection of samples, the blood agar plates were placed in an incubator set to 37°C and left to culture for 48 hours. This incubation process took place in the Department of Microbiology at Malabar Dental College and Research Centre. After the incubation period, the total number of colony-forming units was counted manually and subjected to thorough statistical analysis to assess the findings

3. RESULTS:

The total number of colony-forming units (CFU) from four groups (1, 2, 3, and 4) was counted at two locations: the patient's chest area and the doctor's chest area. After analysing the collected data, it was found that the highest number of CFUs was present in the patient's chest area compared to the doctor's chest area. Additionally, a reduction in CFU count was observed after the use of mouthwash as a pre-procedural mouth rinse. The collected data was statistically analyzed, and the results obtained are as follows:

Both chlorhexidine 0.2% and chlorhexidine 0.12% shows significantly reduced amount of CFUs. The lower concentration of CHX showed maximum acceptability amongst the users. It has been seen that the efficacy of 0.2% CHX (10 ml) and 0.12% CHX (10 ml) are similar, though, the side-effects of 0.12% CHX are less due to the lesser concentration of CHX and it has been noted that the patient compliance is better with 0.12% CHX.

At patient search area

Between the groups, the comparison of CFU in the patient chest area shows that Group 1 has the highest mean at 3.94, followed by Group 4 at 3.22, Group 2 at 2.4, and finally Group 3 at 1.95.(Table 1) (Graph A)

Table 1 – Between group Comparison of CFU AT PATIENT CHEST AREA

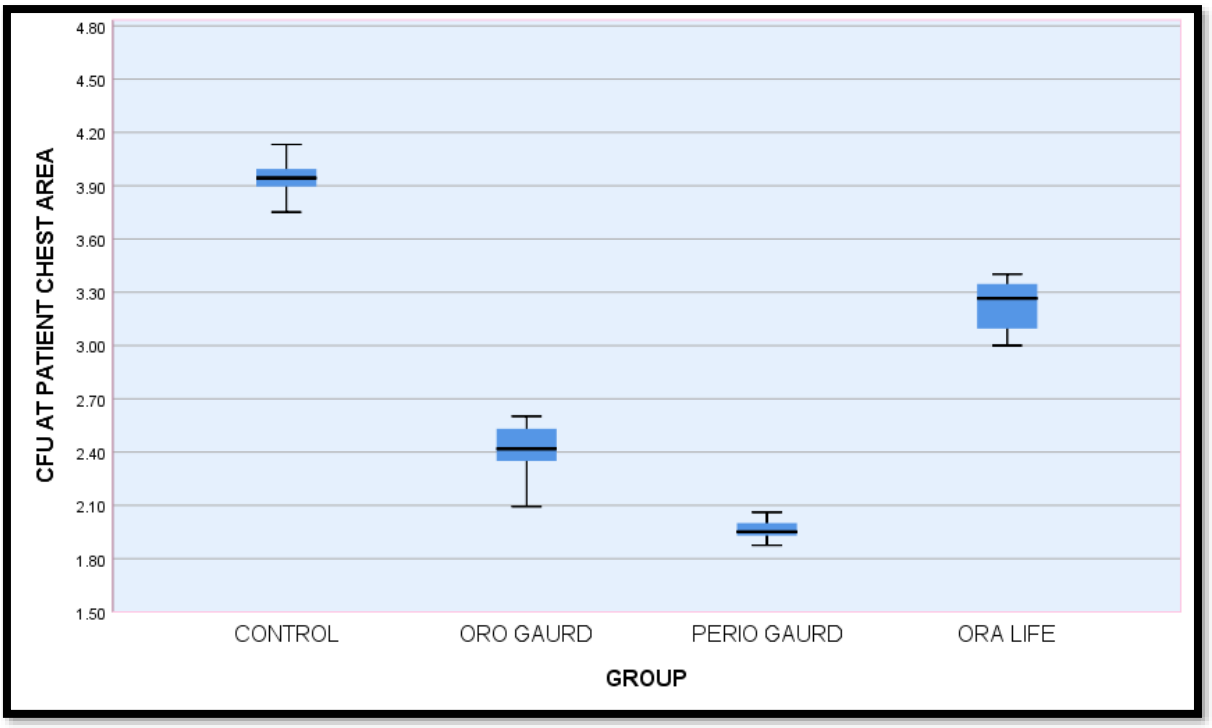
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower	**Upper**		

					Bound	Bound		
CONTROL	**10**	**3.9459**	**.09865**	**.03120**	**3.8753**	**4.0165**	**3.75**	**4.13**
ORO GAURD	**10**	**2.4095**	**.15199**	**.04806**	**2.3008**	**2.5183**	**2.09**	**2.60**
PERIO GAURD	**10**	**1.9580**	**.05711**	**.01806**	**1.9171**	**1.9989**	**1.88**	**2.06**
ORA LIFE	**10**	**3.2261**	**.14622**	**.04624**	**3.1215**	**3.3307**	**3.00**	**3.40**
Total	**40**	**2.8849**	**.78102**	**.12349**	**2.6351**	**3.1347**	**1.88**	**4.13**

Group comparison of mean CFU/mL at the patient chest area was conducted using a one-way ANOVA test, which reported a statistically significant difference (P<0.05).(Table 2)

TABLE 2- ONE WAY ANOVA TEST comparison of mean CFU/ml

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	**23.272**	**3**	**7.757**	**539.876**	**.000**
Within Groups	**.517**	**36**	**.014**		
Total	**23.790**	**39**			



Graph A: Perio Guard has reported least no of CFU/ml at patient's chest area followed by Oro Guard then Ora Life and highest CFU/ml by Control group.

TABLE 3 POSTHOC TEST

(I) GROUP	(J) GROUP	Mean Difference (I-J)	Std. Error	P value	95% Confidence Interval	
					Lower Bound	**Upper Bound**
CONTROL	**ORO GAURD**	**1.53633***	**.05361**	**.000**	**1.3867**	**1.6860**
	PERIO GAURD	**1.98788***	**.05361**	**.000**	**1.8382**	**2.1376**
	ORA LIFE	**.71975***	**.05361**	**.000**	**.5701**	**.8694**
ORO GAURD	**PERIO GAURD**	**.45155***	**.05361**	**.000**	**.3019**	**.6012**
	ORA LIFE	**-.81659***	**.05361**	**.000**	**-.9663**	**-.6669**
PERIO GAURD	**ORA LIFE**	**-1.26813***	**.05361**	**.000**	**-1.4178**	**-1.1185**
*. The mean difference is significant at the 0.05 level.						

*P<0.05 is statistically significant

Bonferroni Post hoc comparison was done to find out the pair group significance and reported significant difference regarding mean CFU/ml at Patient chest area between all the study solutions(P<0.05).

At doctor's chest area

In comparing the CFU at the doctor's chest area, Group 1 had the highest mean at 3.69, followed by Group 4 at 3.04, Group 3 at 2.33, and Group 2 at 1.79.(Table 4) (Graph B)

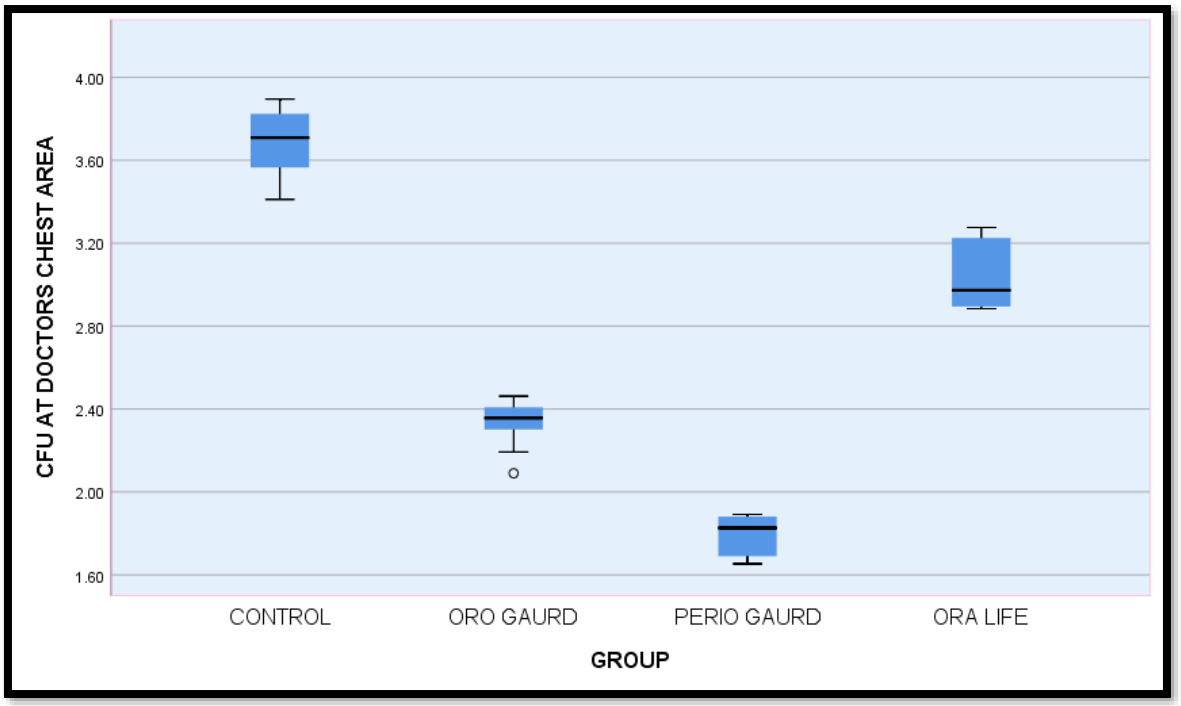
Table 4 – Between group Comparison of CFU AT DOCTORS CHEST AREA

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	**Upper Bound**		
CONTROL	**10**	**3.6921**	**.15117**	**.04781**	**3.5840**	**3.8003**	**3.41**	**3.90**
ORO GAURD	**10**	**2.3314**	**.11258**	**.03560**	**2.2509**	**2.4119**	**2.09**	**2.46**
PERIO GAURD	**10**	**1.7927**	**.09661**	**.03055**	**1.7236**	**1.8619**	**1.65**	**1.89**
ORA LIFE	**10**	**3.0453**	**.16305**	**.05156**	**2.9287**	**3.1620**	**2.88**	**3.28**
Total	**40**	**2.7154**	**.73831**	**.11674**	**2.4793**	**2.9515**	**1.65**	**3.90**

Between-group comparison of Mean CFU/ML at the Doctor's chest area was done using the One-way Anova test and reported a statistically significant difference($P<0.05$).(Table 5)

TABLE 5- ONE WAY ANOVA TEST comparison of mean CFU/ml

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	**20.616**	**3**	**6.872**	**384.742**	**.000**
Within Groups	**.643**	**36**	**.018**		
Total	**21.259**	**39**			



Graph B: Perio Guard has reported least no of CFU/ml at Doctors chest area followed by Oro Guard then Ora Life and highest CFU/ml by Control group.

TABLE 6- POSTHOC TEST

(I) GROUP	(J) GROUP	Mean Difference (I-J)	Std. Error	P value	95% Confidence Interval	
					Lower Bound	**Upper Bound**
CONTROL	**ORO GAURD**	**1.36073***	**.05977**	**.000**	**1.1939**	**1.5276**
	PERIO GAURD	**1.89939***	**.05977**	**.000**	**1.7325**	**2.0663**
	ORA LIFE	**.64679***	**.05977**	**.000**	**.4799**	**.8137**
ORO GAURD	**PERIO GAURD**	**.53866***	**.05977**	**.000**	**.3718**	**.7055**
	ORA LIFE	**-.71394***	**.05977**	**.000**	**-.8808**	**-.5471**
PERIO GAURD	**ORA LIFE**	**-1.25260**	**.05977**	**.000**	**-1.4195**	**-1.0857**
*. The mean difference is significant at the 0.05 level.						

*P<0.05 is statistically significant

Bonferroni Post hoc comparison was done to find out the pair group significance and reported significant difference regarding mean CFU/ml at Doctor chest area between all the study solutions(P<0.05).

4. DISCUSSION:

Research indicates that aerosols and droplets produced in dental settings often become contaminated with bacteria and blood, posing a significant risk to both patients and dental professionals. In light of this the present study aimed to evaluate and compare the effectiveness of three different types of mouthwash in lowering the bacterial load present in the aerosols produced during the scaling process.

Despite the enduring popularity of the original 0.2% formulation, recent studies have revealed that the 0.12% version offers comparable therapeutic benefits while using a lower concentration. This reduction not only maintains the efficacy of the mouth rinse but also leads to a remarkable decrease in salivary bacterial load, with studies documenting a staggering 97%

reduction.[7]

Loe, Schiott et al., Addy et al., and Santos et al. indicates that Chlorhexidine at a concentration of 0.2% was the first mouthwash to be clinically proven effective in preventing the formation of supragingival plaque. This significant finding underscores the utility of Chlorhexidine in dental hygiene practices, as it demonstrated a clear ability to inhibit the growth of plaque on the surfaces of teeth.[8,9,10]

Herbal mouthwashes, despite their notable antimicrobial properties highlighted by various researchers, currently lack a substantial body of evidence supporting their effectiveness as preprocedural rinses for minimizing aerosol contamination. In this study, we utilized blood agar plates to capture airborne microorganisms, as this medium is recognized as a valid and nonselective option for cultivating such organisms. When airborne microorganisms settle onto the surface of the culture medium, they are able to grow and form visible colonies. These colonies are then meticulously counted as colony-forming units (CFUs), providing an accurate measure of the microbial presence in the air studied.[11]

The findings of the current study indicate that the use of 10 ml of 0.12% chlorhexidine as a pre-procedural mouth rinse for a duration of 60 seconds, administered 10 minutes prior to a dental procedure, resulted in a lower concentration of CFUs compared to the same volume of 0.2% chlorhexidine and a herbal mouthwash. FIGURE 1 (GRAPH A).

Guntaas Sethi and Kunal Kumar they compared a 0.2% Chlorhexidine mouthwash, known for its antibacterial properties, with a herbal mouthwash as a pre procedural rinse and concluded that CHX mouthwash was significantly more effective in lowering the bacterial count present in dental aerosols,highlighting its efficacy as a pre-procedural mouth rinse.[12]

S K Rath and colleagues in 2014, explored the clinical and microbiological effectiveness of mouthwashes with two different concentrations of chlorhexidine: 0.2% and 0.12%. Their findings indicated that lower concentration of 0.12% chlorhexidine not only maintained optimal clinical results but also enhanced patient compliance. This suggests that utilizing a milder formulation may lead to better adherence to oral hygiene practices among patients while still achieving significant therapeutic outcomes.[13]

The findings from this study reveal that both dental practitioners and patients are at risk of exposure to contaminated aerosols generated during ultrasonic scaling procedures. Notably, the study observed a significantly higher concentration of colony-forming units (CFUs) in the area around the patient's chest compared to that of the dentist. This suggests that patients are more susceptible to contamination.

The aerosol production cannot be totally eliminated during ultrasonic scaling, but the pathogenic potential of these aerosols can be minimized by preprocedural rinsing. In the present study, 0.2% CHX and 0.12% CHX shows significantly similar amount of reduction in CFUs when used as a preprocedural mouthwash during ultrasonic scaling followed by an herbal mouthwash, respectively.

5. CONCLUSION

During procedures such as ultrasonic scaling, both patients and dental practitioners face a heightened risk of cross-infection due to the generation of aerosols. The findings of the current study shows that usage of pre procedural mouthrinse will reduce the amount of bacterial count in aerosols produced during ultrasonic scaling. The lower concentration of 0.12% chlorhexidine not only maintained optimal clinical results but also enhanced patient compliance.

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