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ORIGINAL RESEARCH

EFFICACY OF FLAX SEED OIL AS A PRE PROCEDURAL MOUTH RINSE IN REDUCING BACTERIAL COUNT IN DENTAL AEROSOL DURING ULTRASONIC SCALING – A RANDOMIZED CONTROL STUDY

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Background: Dental professionals are exposed to microbial contamination from aerosols produced during procedures like ultrasonic scaling. Conventional chemical rinses such as 0.2% chlorhexidine (CHX) are effective in reducing microbial load but have undesirable side effects, including mucosal irritation and taste alteration. Herbal alternatives such as flax seed oil, rich in omega-3 fatty acids and lignans, exhibit anti-inflammatory and antimicrobial properties, potentially providing a safer and effective substitute

Materials and Methods: A randomized double-blind controlled study was conducted on 30 healthy participants aged 18–35 years, who were equally divided into three groups: Group A received 20 ml of normal saline, Group B received 20 ml of 0.2% chlorhexidine, and Group C received 20 ml of flax seed oil as a pre-procedural rinse for one minute before ultrasonic scaling. Aerosols generated during the procedure were collected on blood agar plates placed on patients' chests, which were then incubated at 37 °C for 24 hours to determine the colony-forming units (CFUs). The data were statistically analyzed using one-way ANOVA followed by Games-Howell post hoc test, with a significance level set at $p \leq 0.05$.
Results: The mean CFU count was 197.3 ± 38.5 for normal saline, 98.4 ± 20.7 for chlorhexidine, and 51.6 ± 26.8 for flax seed oil. The reduction in bacterial load was statistically significant across the three groups ($p < 0.05$). Pairwise comparison showed that flax seed oil achieved a significantly greater reduction in CFUs compared to both chlorhexidine and saline
Conclusion: Flax seed oil demonstrated superior efficacy in reducing bacterial contamination in dental aerosols compared to chlorhexidine and normal saline. As a natural, biocompatible alternative with minimal side effects, flax seed oil can be recommended as an effective pre-procedural mouth rinse to minimize microbial transmission risk during ultrasonic scaling.

***Keywords*:** Flax seed oil, Pre-procedural mouth rinse, Ultrasonic scaling, Dental aerosols, Chlorhexidine, Antimicrobial acti

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INTRODUCTION

Dentists, dental hygienists, and other dental workers operate in a highly contaminated environment—the human mouth—exposed to a variety of microbes. They are at high risk of developing various infectious diseases.[1] Some dental equipment, when used for different procedures, results in the formation of aerosols and splatter. Aerosols are small particles measuring 50 microns or less in diameter that remain suspended in the air and pose potential health hazards. Microorganisms present in the mouth and respiratory tract can be transported via aerosols during ultrasonic scaling.[1] A number of chemical agents possess antimicrobial action and inhibit the development of gingival diseases, such as 0.2% chlorhexidine gluconate, which is considered the gold standard pre-procedural mouth rinse before ultrasonic scaling. However, it has several side effects, including taste alteration, mucosal erosion, and enhanced supragingival calculus formation.[2] [3] Furthermore, resistance to chlorhexidine has been reported against periodontal pathogens. Herbal mouth rinses such as flax seed oil offer a safe and effective alternative to chlorhexidine.[4–6] Flax seed oil contains mediators that promote the resolution of inflammation and possess antimicrobial properties, thereby improving host responses to periodontal disease.[4]

Thus, the aim of the study is to assess the efficacy of an antimicrobial herbal agent, flax seed oil, as a pre-procedural mouth rinse before ultrasonic scaling in reducing the colony-forming units on blood agar plates, thereby lowering the risk of aerosol contamination in dental practice, and to compare its efficacy with that of commercially available chlorhexidine mouth rinse and normal saline.

MATERIAL AND METHODS

The current study was a randomized double blinded study. Thirty healthy individuals of age range 18 to 35 years were selected for the study. The purpose of the study and informed consent were obtained from all the participants. The study was carried out after approval from the institutional ethical committee. Study populations were randomly assigned into three groups.

Inclusion criteria - Patients with ≥20 teeth (minimum of five teeth per quadrant), with plaque index scores of 1.5-3, with probing depth of ≤3 mm.

Exclusion criteria - Patients with other oral lesions, wearing any fixed or removable prosthesis, and with any past history of systemic illness or allergy to components of mouth rinse.

Group (A) – 10 patients underwent scaling after pre-procedural rinsing with 20 ml of Normal saline for a minute. Group (B) - 10 patients underwent scaling after rinsing with 20 ml of 0.2% Chlorhexidine for a minute, Group (C) - 10 patients underwent scaling after rinsing with 20 ml of flax seed oil for a minute. To avoid aerosol contamination, the operation area were fumigated 24hrs before the treatment.

Before ultrasonic scaling, agar plates [Figure 1] were placed and stabilized with adhesive tape on patient's chest for aerosol collection. The treatment was performed by a single operator.

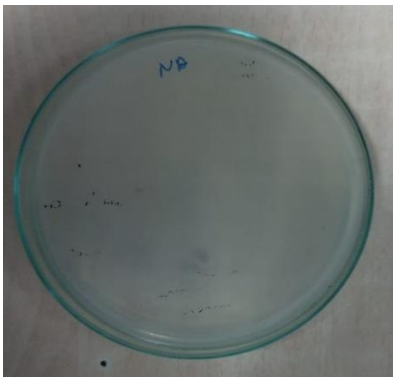

Figure 1. Agar plate

All agar plates were sent for microbiological analysis for Colony Forming Unit (CFU) count on the same day of ultrasonic scaling procedure.[Figure 2]

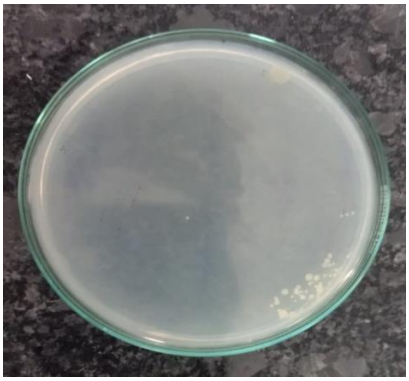

Figure 2. Colony forming units in Agar plates

MICROBIOLOGICAL ANALYSIS

The aerosols were collected on agar plates prepared from blood agar medium which is considered as a

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favorable medium for the growth of air borne bacteria. The plates were incubated at 37°C in an incubation chamber for 24 h and then colony forming units (CFUs) were counted.

RESULT

Statistical analysis was carried out using SPSS Version 17.0 software version. Descriptive statistics were performed. The colony forming units (CFU) values were log transformed prior to analysis. ANOVA test was carried out to analyze the difference in reduction of colony forming units between three groups. Hence homogenous of variance were not assumed, a post hoc Games-Howell test was performed to ascertain which pairs of mouth wash differ significantly from one another. A $p \leq 0.05$ was considered for statistical significance.

The mean CFU at chest level in normal saline treated group showed 197.3. Minimum of 134 and maximum of 254 CFU found on agar plates placed at chest level of normal saline treated patients. The mean CFU at chest level in CHX treated group showed 98.4. Minimum of 68 and maximum of 123 CFU found on agar plates placed at chest level of CHXs treated patients. The mean CFU at chest level in flax seed oil treated group showed 51.6. Minimum of 9 and maximum of 84 CFU found on agar plates placed at chest level of flax seed oil treated patients as shown in Table 1.

Table.1. Comparison of Bacterial load (Colony forming units) in bio aerosol between groups

Groups	Mean	Minimum	Maximum	P Value
Grp A (Normal saline)	2.28	2.13	2.4	0.001**
Grp B (Chlorhexidine)	1.98	1.83	2.09	
Grp C (Flax seed extract)	1.63	1.32	2	

[a] **- Log transformed values prior to ANOVA test; ** shows (p value <0.001)**

Post hoc pairwise comparison of Bacterial load (Colony forming units) between groups using

Post hoc pairwise comparison of Bacterial load (Colony forming units) between groups using Games-Howell test revealed that mean difference is statistically significant at the 0.05 level as shown in Table 2.

Table 2. Post hoc pairwise comparison of Bacterial load (Colony forming units) between groups using Games-Howell test

(I) grp	(J) grp	Mean Difference (I-J)	95% Confidence Interval		p value
			Lower Bound	*Upper Bound*	
Grp A	Grp II	.30294*	0.197	0.4089	0.001*
	Grp III	.64920*	0.3408	0.9576	0.001*
Grp B	Grp I	-.30294*	-0.4089	-0.197	0.001*
	Grp III	.34626*	0.0375	0.655	0.027*
Grp C	Grp I	-.64920*	-0.9576	-0.3408	0.001*
	Grp II	-.34626*	-0.655	-0.0375	0.027*

Post hoc Games-Howell test *. The mean difference is significant at the 0.05 level

DISCUSSION

Dentists, dental hygienists, and other dental workers operate in a highly contaminated environment—the human mouth—which is exposed to a variety of bacteria, viruses, fungi, and other microbes. The use of various dental instruments during clinical

procedures results in the formation of aerosols and splatter. Microbes present in the oral cavity and respiratory tract can be transmitted through aerosols generated during procedures such as ultrasonic scaling, potentially leading to respiratory and systemic infections in operators. This represents a major occupational risk for dental professionals due to the possible transmission of infectious agents.

A fourfold increase in airborne bacterial levels has been observed in areas of aerosol emission during scaling procedures. Oral bacteria have been detected as far as two meters from the working area, confirming the existence of aerosolized oral microbes in dental practice. These airborne particles originate from blood, saliva, tooth debris, dental plaque, calculus, and restorative materials produced during ultrasonic scaling. Therefore, preventive measures must be adopted by dentists to minimize cross-contamination with infectious agents.[7–8]

The present study demonstrated that a significant number of aerosols are generated from patients during ultrasonic scaling. It further evaluated and compared the efficacy of different pre-procedural mouth rinses in reducing bacterial load in dental aerosols, particularly assessing the effectiveness of a herbal rinse—flax seed oil—against the gold standard chlorhexidine mouth rinse.

The study results revealed a significant reduction in bacterial counts with all pre-procedural mouth rinses compared to saline, with flax seed oil showing the greatest reduction, followed by chlorhexidine. Flax seed oil, a vegetable fat, undergoes saponification when acted upon by salivary alkalis such as bicarbonates. Allura Deepika et al. demonstrated the antibacterial effect of flax seed extract against oral pathogens.[4] This natural product exerts a positive action against commonly occurring oral microbes, attributed to its bioactive components such as alpha-linolenic acid (ALA), essential omega-3 fatty acids, proteins, dietary fiber, and secoisolariciresinol diglucoside (SDG). SDG possesses antiviral, antibacterial, antifungal, and antioxidant properties.[4]

Other herbal agents, such as *Syzygium cumini* (jamun) seeds, also exhibit hypoglycemic, antimicrobial, anti-inflammatory, hypolipidemic, and antioxidant effects.[9] The medicinal value of these seeds arises from organic acids like maleic, oxalic, and gallic acid, while their antimicrobial potential is mainly attributed to tannins.[9–12] Shaikh et al. demonstrated the antibacterial activity of ethanolic extracts of *Syzygium cumini* against both gram-positive and gram-negative organisms.[11] Brito et al. also reported the antimicrobial and antiplaque properties of aqueous and methanolic extracts from jamun bark.[13–14]

The findings of this study support the potential use of herbal pre-procedural mouth rinses, particularly flax seed oil, to effectively reduce the number of oral bacteria and minimize the risk of transmission to dental personnel during ultrasonic scaling. However, the study was limited by its focus on bacterial aerosols only; viruses and fungi, which require specialized media for culture, were not included. Additionally, CFU counts provide only approximate bacterial quantification and do not account for other viable microbes in aerosols. Clinically, these results emphasize that pre-procedural mouth rinsing should be considered mandatory before ultrasonic scaling to reduce disease transmission in dental settings.

CONCLUSION

This study helps us to know the significance of pre-procedural mouth rinses in reducing bacterial load in aerosals produced during ultrasonic scaling and prevention of transmission of diseases. It also signifies the effect of herbal mouth rinses inhibiting bacterial contamination compared to chlorhexidine which is a chemical mouth rinse and also proved its effectiveness in regular practice as pre-procedural mouth rinse during ultrasonic scaling in dental office.

DECLARATIONS

Ethics approval and consent to participate

Not applicable

Conflicts Of Interests

None

Author Contribution

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None

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