

CLINICAL EFFICACY OF 0.2 % CHLORHEXIDINE, OCIMUM SANCTUM, AND EUCALYPTOL MOUTHWASHES IN THE TREATMENT OF GINGIVITIS

Maryam Panhwar¹, Syed Zafar Abbas², Ambrina Qureshi³, Rida Batool⁴, Fizza Abidi⁵, Qaiser Ali Baig⁶

¹. Assistant Professor, Dept of Community and Preventive Dentistry Ziauddin College of Dentistry, Pakistan

². Assistant Professor, Dept of Oral Medicine DIDC, DUHS, Pakistan

³. Professor and Chairperson, Dept of Community and Preventive Dentistry DIDC, DUHS, Pakistan

⁴. Lecturer, Department of Community Dentistry DIDC, DUHS, Pakistan

⁵. Assistant Professor, Dept of Oral Pathology Ziauddin College of Dentistry, Pakistan

⁶. Associate Professor, Dept of Community and Preventive Dentistry DIDC, DUHS, Pakistan

Correspondence:

Maryam Panhwar

dr.maryam.2101@gmail.com

Abstract

Background: Periodontal diseases are documented as major public health issues in developing countries as the well-developed world; they can be treated with an effective measure of plaque control including personal plaque control and professional treatment measures. Still, due to the affordability of people in Pakistan and some side effects regarding chemical plaque control, it is difficult to achieve the goal that primarily concerns overall well-being, including oral health.

Objective: To evaluate and compare the effectiveness of 0.2% Chlorhexidine, Enziclor, Ocimum Sanctum and Eucalyptol mouthwashes in managing plaque-induced gingivitis.

Materials and Methods: This experimental study experimental study was conducted for 6 months at Dental OPD of Dow International Dental College on 60 patients randomly divided into groups by lottery method Group A- 0.2% Chlorhexidine, Group B- Ocimum Sanctum Mouthwash, and Group Eucalyptol mouthwash. Baseline data was followed by Day 1, Day 7 and Day 14. Side effects and complaints were also recorded at every follow-up by questionnaire. ANOVA tests was used for statistical analysis, and significance results were considered when ($p < 0.05$).

Results: Overall, plaque and gingival scores were reduced as improved oral health status of the participants in all three management groups, intergroup comparison within the three different management groups showed that when Group A- 0.2% Chlorhexidine compared with both Group B -Ocimum Sanctum Mouthwash and Group C- Eucalyptol mouthwash at the Day 14 showed statistically significant results ($p = .000$). No any side effects were observed throughout duration.

Conclusion: All three types of mouthwash were equally effective, natural products having no side effects and also affordable. Ocimum sanctum and eucalyptol being herbal products have no side effects like Chlorhexidine and it is more affordable.

Keywords: Ocimum Sanctum, Chlorhexidine, Mouthwash, Eucalyptol mouth wash Management, Gingivitis

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Introduction

Periodontal diseases are documented as a major concern of public health problems¹; various epidemiological studies showed that periodontal diseases of the periodontium can be controlled by

regular plaque control procedures at home². The majority of people might not have the drive or skills to use these oral hygiene items (toothbrushes, floss) effectively. Consequently, a chemical plaque control

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strategy is preferred to address any potential shortcomings in daily self-performed dental hygiene³. Chemical agents have so been used as an adjunct. Over the past three to four decades, significant research has focused on chemical methods for managing supragingival plaque. This has led to a surge in antimicrobial products on the market, specifically designed to inhibit bacterial growth during plaque formation⁴.

The great majority of synthetic products contain a disinfectant, which is essential in avoiding dental plaque accumulation. After toothpaste, mouthwashes are widely recognized by antimicrobial experts as one of the most effective delivery systems for targeting and controlling microbial activity⁵. A mouthwash is a medicinal liquid that is gargled in the mouth while being held there by the perioral muscle to flush away oral infections⁶. Mouth rinses can spread the therapeutic action across the entire tooth surface, including interproximal areas where even toothpaste is only marginally effective⁷. A variety of chemical substances with antiseptic or antimicrobial action, such as phenol, bis-biguanides, pyrimidines, quaternary ammonium compounds, oxygenating agents, halides, and heavy metal salts, have been used, with varying degrees of success, to inhibit plaque formation and the progression of gingivitis⁸.

Chlorhexidine bacteriostatic and bactericidal characteristics are responsible for its effectiveness⁹, however, due to its negative effects¹⁰, it includes staining of the oral mucosa, teeth, and tongue, loss of taste, and an increased rate of supragingival calculus formation. Prolonged use is limited¹¹.

Herbal mouthwash is an excellent option for individuals who prefer to avoid alcohol (e.g., those with xerostomia), sugar (e.g., diabetics), artificial preservatives, and synthetic colours in their oral care products. Its natural ingredients and lack of known adverse effects make it a suitable choice¹². The usage of plant and plant-based materials in alternative medicine has advanced significantly, giving rise to toothpaste and mouthwashes. It has been demonstrated that they have positive effects in lowering plaque and irritated gums. Additionally, the usage of plant extracts can significantly diminish the drug resistance linked to the abuse of chemotherapeutic medicines¹³. According to a recent study, tulsi has antiviral, antifungal, and antibacterial

activities, *Ocimum sanctum* (Tulsi's) has wide-ranging activity, which includes action against the bacteria that cause tooth decay, also it can also be used as an herbal mouthwash to treat oral conditions such as mouth ulcers, gum disease, and bad breath¹⁴. Tulsi is preferred in a mouth rinse because of its taste, it is helpful in wound healing due to its distinctive combination of antibacterial, antioxidant, anti-inflammatory, and analgesic properties¹⁵. Because of the numerous properties of *Ocimum sanctum* (tulsi) along with its other advantages like easy availability, the present study was undertaken to compare *Ocimum Sanctum*'s efficacy with commercially available Chlorhexidine and eucalyptol mouthwash in the Management of plaque-induced gingivitis.

Material and Method:

The experimental study was conducted over six months, from May 2023 to November 2023, at the Outpatient Department (OPD) of the Periodontology Department, Dow International Dental College, Dow University of Health Sciences (DUHS). The study was registered as a clinical trial with ClinicalTrials.gov (Registration No. NCT051940721). The study included patients aged 18 to 35 years who exhibited plaque-induced gingivitis without evidence of periodontitis and were in generally good systemic health. Eligibility criteria also required participants to have a minimum of 20 teeth for evaluation. The Ethical Review Board of Institute Ref: IRB-2634/DUHS/Approval/2023/384 approved the study. Voluntary verbal and written informed consent were obtained from all the selected participants. Before the distribution of mouthwashes all subjects were examined and assessed for the initial plaque status by PI (Silness P and Loe) GI assessment of gingival health by (Loe H and Silness) by the principal investigator. The score for the plaque index was recorded by using a disclosing agent. After recording the clinical parameters, an investigator randomly allocated the subjects (lottery method) to the 3 groups.

GROUP 1. (Positive control)-Chlorhexidine mouthwash

GROUP 2 (Treatment Group)-*Ocimum Sanctum* mouthwash

GROUP 3 (Treatment Group)-Eucalyptol mouthwash

A total of 60 participants were recruited for the study through simple random sampling, with 20 individuals allocated to each group. To ensure blinding, mouth rinses were distributed in opaque, unlabelled bottles, preventing participants from identifying their assigned treatment group. All of the participants were motivated on regular intervals by personal and phone contact, to use toothbrushes and mouthwash regularly. The patients were told to clean their teeth twice per day for a minimum of three minutes, using just one type of toothpaste, and using a soft toothbrush. They were given instructions to use the traditional Bass brushing technique, to rinse at least for 30 seconds after brushing their teeth, and not to drink anything, all participants were instructed to use the provided 15 ml of mouthwash and rinse for 30 seconds after twice brushing.

Preparation of Mouthwash

Fresh *Ocimum sanctum* leaves were harvested from courtyards and meticulously processed under controlled conditions for washing and drying. After drying, the leaves were finely pulverized into powder form. A total of 300 grams of the powdered *Ocimum sanctum* was soaked in 100% ethanol for one week in a round-bottom flask, which was stored in a dark environment to protect the active components from light degradation.

The mixture was filtered sequentially using Whitman No. 1 filter paper and a muslin cloth to remove coarse debris. The filtrate was then concentrated at a controlled temperature of 50°C to obtain a solid residue of *Ocimum sanctum* extract. The extraction process yielded 18 grams of residue from 300 grams of powder, equating to a yield of 6% (w/w).

The extract was subsequently dissolved in polyethylene glycol (PEG) 400 (20% v/v), and sterilized distilled water was added to achieve a final concentration of 4% (w/v). Spearmint oil was incorporated as a flavoring agent at a concentration of 0.005% to enhance acceptability¹⁶.

DATA COLLECTION TOOL

All Subjects (n=60) were assessed at different intervals of time in the Department of Periodontology of Dow International Dental College.

Day 1

Plaque and gingival scores were recorded of all three group participants

Group A-C (n=20/ group)

Group 1 (n=20) CHX,

Group 2 (n=20) *Ocimum Sanctum*

Group 3 (n=20) Eucalyptol

Day 7

Recording of variables, plaque and gingival scores.

Day 14

Recording and measuring Gingival Index, Plaque Index, any side-effects and acceptability of mouthwashes were recorded by the questionnaire.

Statistical Analysis:

The Data was analyzed by statistical software package SPSS version 20 (SPSS Inc; Chicago, USA). The age of participants and gender distribution were calculated by simple descriptive statistics. Mean $\pm$ SD will be used for age gender ratios and percentage. ANOVA-test was used for comparisons within the groups and ANOVA test was used for intra-group comparisons. Results will be regarded as statistically significant when $p < 0.05$.

Results:

A total of 100 participants were initially screened for this study, of which 60 met the inclusion criteria. These eligible participants were then randomly assigned to three distinct study groups as shown in Fig. 1. Based on the study, the age and gender of the participants in the groups were not significantly different from one another as shown in the table no: 1.

Table no:1 Demographic characteristics of study subject					
Gender	Chlorohe xidine	Ocimum	Eucaly ptol	Total	P- val ue
Male n(%)	8(32)	8(32)	9(36)	25(10 0)	0.1 52
Female n(%)	12(34)	12(34)	11(31)	35(10 0)	
Overall n(%)	20(33)	20(33)	20(33)	60(10 0)	
Age (M $\pm$ SD)	25.60 $\pm$ 5.924	26.20 $\pm$ 5.435	28.65 $\pm$ 3.977	26.82 $\pm$ 5.26 1	0.1 52

Gingival scores showed positive changes in overall gingival status from day 1 to 14 within the groups as shown in Graph no: 1. The plaque index also showed significant improvement from week to week as shown in Graph no: 2.

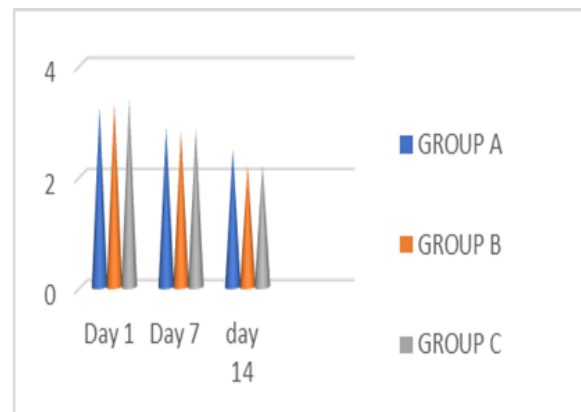
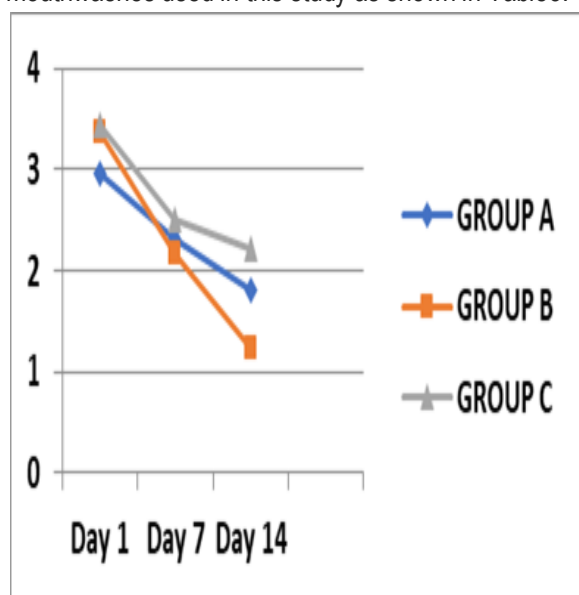
Graph # 01 Changing trends of Gingival index during the study Week-to-week comparison revealed significant improvement ($p < 0.001$)	Graph # 02: Changing trends of plaque index during the study Improved significantly from each week to the following week ($P < 0.001$).
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Intra-comparison within the management groups was calculated by using repeated ANOVA tests depicting that there was no statistical difference seen on the 14th day within groups. ($p = 0.000$) as shown in Table no: 2

Table no:2 Intragroup comparison of all three groups				
Dependent Variable	Management Groups	Management Groups	Mean Difference	P Value.
Day 7		Listerine	.4780*	.000
		Listerine	.0805	.403
	Chlorhexidine	Occimum	.1415	.500
		Listerine	-.1951	.196
	Occimum	Chlorhexidine	-.1415	.500
		Listerine	-.3366*	.009
	Eucalyptol	Chlorhexidine	.1951	.100
		Occimum	.3366*	.009
Day 14	Chlorhexidine	Occimum	.5634*	.000
		Listerine	-.4049*	.000
	Occimum	Chlorhexidine	-.5634*	.000
		Listerine	-.9683*	.000
	Eucalyptol	Chlorhexidine	.4049*	.000
		Occimum	.9683*	.000

Table no:3Acceptability of using mouth		
	Experience mouthwashes	Percentage
Good	60(60)	100%
Discomfort	-	-
Neutral	-	-
Total	60	100%

When asked about the acceptance of new mouthwashes all the participants showed 100% satisfactoriness without any discomfort to the mouthwashes used in this study as shown in Table3.



Discussion:

This study was conducted to evaluate the effectiveness of three different mouth rinses in a younger population with mild to moderate gingivitis, attending the Dental OPD at Dow International Dental College, DUHS Karachi. The research was carried out in Karachi, a region with a diverse ethnic population. The results indicated no significant statistical differences between the groups in terms of age, gender, or ethnicity. This aligns with previous studies, which have demonstrated that chemical plaque control methods are equally effective as mechanical brushing in individuals, regardless of age or gender¹⁷.

Furthermore, during the two-week follow-up period, the herbal alternative mouth rinse revealed a notable decline. In both the parameters gingival and plaque index. Similar to this research, another study also proved that Ocimum sanctum-based mouthwash is just as efficient as Chlorhexidine in lowering periodontal problems¹⁸.

Studies have demonstrated that the most effective anti-plaque and anti-gingivitis chemical agents are those containing Chlorhexidine substance, this past research also demonstrated that chemical agents that contain Chlorhexidine cause possible damage to prokaryotic membranes of cells by inducing cytoplasm component damage, enhancing permeability, and causing the destruction of cells to exert its antibacterial actions. Rinsing with Chlorhexidine can have several local adverse effects, including increased supragingival calculus formation, browning of the teeth and tongue, and taste impairment. Desquamation of the oral mucosa can also result from chlorhexidine rinsing; however, this is less typical¹⁹.

In contrast to the adverse effects associated with Chlorhexidine solution, research on alternative

agents, such as Listerine, has demonstrated that these mouthwashes maintain optimal gingival health over three weeks²⁰. The data from this research demonstrated that all three types of mouthwash were similarly effective in lowering indices and maintaining good gingival health within the groups in comparison to the baseline findings. Accompanied with the favorable subjective experience of participants of herbal mouth rinse users, which included taste alteration, dryness or burning mouth sensation in contrast outcomes observed with CHX.

It has been discovered that *Ocimum* is a well-known therapeutic herb in Ayurvedic medicine that is frequently used as a mouthwash and in daily rituals as an antibacterial agent with anti-gingivitis and anti-inflammatory effects²¹. In addition to antimicrobial compounds such as caracole (5-isopropyl-2-methylphenol), eugenol (1-hydroxy-2-methoxy-4-allylbenzene), ursolic acid (3 β -tetradecahydro-1H-picene-4a-carboxylic acid), and linalool (3,7-dimethyl-1,6-octadien-3-ol), the stem and leaves of *Ocimum sanctum* also contain various bioactive constituents, including tannins, flavonoids, triterpenoids, and saponins, which may exhibit antibacterial properties. These chemicals interact with soluble proteins in saliva to generate high-molecular-weight complexes, which promote bacterial destruction on tooth surfaces and in saliva while hindering the processes by which bacteria cling to tooth surfaces²².

Recently, herbal remedies have become popular as management tools for skin and oral mucosa. They could be utilized as low-cost substitutes for traditional treatments or as a long-term agent in maintenance therapy. People who are suffering negative effects from Chlorhexidine therapy may also utilize them. Additional prospective clinical research investigating the anti-inflammatory properties of *Ocimum* mouthwashes should use a bigger sample size. The effectiveness will assist define the function of *Ocimum* in plaque control. *Ocimum* has to undergo a longer clinical trial with a larger sample size and microbiological analysis to prove that it is a reliable plaque-reducing agent²³.

Conclusion:

All three mouthwashes were equally effective, in comparison to natural products with no side effects.

Conflict of interest:

There was no conflict of interest.

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