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Comparison of Effectiveness of *Salvadora persica* Mouthwash with Chlorhexidine and Scaling Alone in Gingivitis

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ABSTRACT

Introduction: Mechanical plaque control, despite best efforts, sometimes fails to completely remove dental biofilm. Variety of chemical agents have also been used as an adjunct to those mechanical aids. Among them, Chlorhexidine (CHX) is the most studied and effective agent. However, due to its unwanted side effects, the use of herbal components that are relatively safe are considered these days.

Objective: To compare the effectiveness of *Salvadora persica* (SP) with Chlorhexidine mouthwash as an adjunct and scaling alone in the treatment of gingivitis.

Methods: A non-randomised clinical trial was done among 63 participants with gingivitis at Periodontology and Oral Implantology Unit, Bir Hospital between 2022 February to 2023 September. Patients recruited after ethical approval, using convenience sampling method, were divided into three groups - CHX, SP, and scaling alone. Plaque index (PI) and Gingival index (GI) for all three groups were recorded at baseline and day 21. Intragroup comparison of PI and GI at baseline and day 21 and intergroup comparisons between each groups were performed.

Results: For CHX, SP, and Scaling alone group, the mean PI and GI was significantly decreased on day 21 ($p < 0.05$). However, on multiple comparisons there were no statistically significant differences between the means of the groups being compared.

Conclusions: The absence of statistically significant differences between the intervention groups suggests a comparable efficacy among the three approaches in treatment of gingivitis.

Keywords: Chlorhexidine; gingivitis; herbal; plaque control; *Salvadora persica*; scaling.

INTRODUCTION

Gingivitis refers to inflammatory condition of gingiva and occurs due to biofilm accumulation at gingival margin and apical to it.[1] In the prevention and treatment of periodontal diseases, plaque control and bacterial biofilm removal are critical.[2] Self-performed oral hygiene and professional mechanical plaque removal are equally essential for restoring periodontal health in gingivitis patients. Scaling and root planing are considered the gold standard of periodontal therapy. Mechanical plaque control, despite best efforts, sometimes fails to completely remove dental biofilm. So, variety of chemical agents have also been used as an adjunct to those mechanical aids in treatment of gingivitis. Among them, Chlorhexidine (CHX) is the most studied and effective agent.[3] However, due to its unwanted side effects, use of herbal components that are relatively safe are recommended these days.[4]

With the increased popularity of herbal oral care products, clinicians must make evidence-based judgments when recommending those. In addition, there is a dilemma whether mouth rinses as adjunct to Scaling are superior to only Scaling in treatment of gingivitis. The therapeutic effects of herbal mouthwashes on both dental plaque and gingival inflammation are not consistently demonstrated in the literature. Therefore, the aim of this study was to

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compare the effectiveness of *Salvadora persica* with Chlorhexidine mouthwash as an adjunct and Scaling alone in the treatment of gingivitis.

METHODS

This non-randomised clinical trial was performed in patients visiting Periodontology and Oral Implantology Unit, Department of Dental Surgery, Bir Hospital who were diagnosed with gingivitis. Duration of current study was 19 months starting from 2022 February to 2023 September. Data collection was done between 2022 July to 2023 July after obtaining ethical approval from the Institutional Review Board of National Academy of Medical Sciences (Ref. 74/2079/80 and Ref. 821/2080/81). This study adheres to the tenets of the Declaration of Helsinki as revised in 2013. A written informed consent was taken from each participant before beginning the study. Non-probability convenience sampling method was used for the selection of study participants using predetermined inclusion and exclusion criteria.

Patients between 20-50 years of age diagnosed with gingivitis were included in this study. Those patients with non-plaque induced gingivitis or periodontitis, systemic diseases that is known to influence periodontal tissues like Type 2 Diabetes Mellitus, Leukaemia and Blood dyscracias, etc., who are under any medications that is known to influence periodontal tissues (Calcium channel blockers, Anticonvulsants, Cyclosporine, and Non-steroidal anti-inflammatory drugs) and Pregnant and lactating women, were excluded from this study. Those with habit of smoking or consuming any form of smokeless tobacco, who had undergone any periodontal surgery in past three months, any allergy to test and control agent and history of antibiotic use and use of any form of herbal products or any other chemotherapeutic antiplaque or antigingivitis products in last 90 days and undergoing active orthodontic treatment were also not included.

The principal investigator (first author) under appropriate supervision conducted the process of data collection. The study population comprised of 63 participants. The individuals who were diagnosed with gingivitis {patients with bleeding on probing (BOP) score ≥10% with probing depth ≤3mm}[5] were assigned to three groups: Group A, Group B, and Group C each consisting of 21 participants.

Group A, the CHX group: positive control; 0.2% Chlorhexidine gluconate mouthwash was prescribed after scaling, n = 21. Group B, the SP group: test group; *Salvadora persica* mouthwash was prescribed after scaling, n = 21. Group C, the Scaling alone group: control group; only Scaling was performed, n=21.

Demographic information was obtained for every patient in each of the three groups through the utilisation of a pre-established questionnaire, the Proforma. Prior to initiating treatment, proper history taking and clinical examination were done. The clinical examination encompassed the assessment of the Gingival index (GI, Loe and Silness, 1963)[6] and Plaque index (PI, Silness and Loe, 1964).[6] These indices were recorded both at the baseline and after a period of 21 days following the intervention. In all participants, baseline measurements were taken and scaling was done using ultrasonic scalers. All participants were provided with oral hygiene instructions. Modified bass brushing and flossing technique were demonstrated for each patient.

The patients in both Group A and Group B were provided with specific instructions to utilise the assigned mouth rinse - For Group A - after Scaling procedure, 0.2% CHX, in a quantity of 10 ml, twice daily for a duration of 60 seconds was advised. While for group B - after Scaling, they were advised to use the *Salvadora persica* mouth rinse in a quantity of 15 ml, twice daily for a duration of 30 seconds. These instructions were to be followed in combination with their regular oral hygiene routine, after a period of thirty minutes following tooth brushing for a duration of one week. The individuals were instructed to utilise a soft-bristled toothbrush and a low abrasive dentifrice in order to brush their teeth.

Patients were scheduled for follow up appointments at one-week intervals to assess their oral hygiene status and compliance. In cases where patients were noncompliant with oral hygiene recommendations, instructions were reinforced. Subsequently, they were scheduled for a follow up appointment on the 21st day, during which the indices were once again recorded.

The collected data were analysed using the statistical program IBM SPSS Statistics for Windows, version 29 (IBM Corp., Armonk, N.Y., USA). The Shapiro-Wilk test was utilised to assess the normality of the data. A paired t-test was used to compare the PI and GI within the same group at baseline and day 21 except PI for *Salvadora persica* group as the data of this group did not have normal distribution. Therefore, Wilcoxon signed rank test was conducted to compare the baseline and day 21 PI values within the *Salvadora persica* group. Intergroup comparisons were conducted to assess the PI and GI, utilising a one-way analysis of variance (ANOVA) test. Subsequently, a post hoc analysis employing the Tukey honestly significant difference (HSD) test was performed to determine the significance of the differences between each of the groups. The level of significance was established at a p-value threshold of less than 0.05.

RESULTS

Out of 63 study participants, majority 55.56% (n=35) of the study participants were female and 44.44% (n= 28) were male.

The age of the study participants ranged from 20 years to 47 years but majority of participants were between age group 20-35 years with mean age being 28.43±6.49 years.

On intragroup comparison of PI and GI in CHX group, PI decreased significantly from 1.68±0.62 at baseline to 0.612±0.26 at day 21. Similarly, GI decreased from 1.62±0.60 at baseline to 0.64±0.31 at day 21. On comparison of GI in SP group, GI showed a significant decrease from 1.58±0.60 at baseline to 0.57±0.21 at day 21. For scaling only group, the mean PI decreased significantly from 1.61±0.52 at baseline to 0.53±0.23 at day 21. The GI also showed a significant decrease from 1.35±0.59 at baseline to 0.37±0.14 at day 21. The p-values associated with each comparison are all less than 0.05, indicating highly significant difference (Table 1).

Data from baseline PI and final PI for SP group was deviated from normal. So, Wilcoxon signed rank test was done for this data. The p-value was less than 0.001, which is highly significant. This indicates that there is a significant difference between the paired observations meaning PI at baseline and day 21 for SP group (Table 2).

When the variables were subjected to an ANOVA test, there were no statistically significant difference

Table 1: Intragroup comparison in all three groups at baseline and day 21.

Variable		Mean±SD		p-value
		Baseline	Day 21	
Chlorhexidine	Plaque index	1.68±0.62	0.612±0.26	<0.01
	Gingival index	1.62±0.60	0.64±0.31	<0.01
Salvadora persica	Gingival index	1.58±0.60	0.57±0.21	<0.01
Scaling	Plaque index	1.61±0.52	0.53±0.23	<0.01
	Gingival index	1.35±0.59	0.37±0.14	<0.01
Paired t-test.				

Table 2- Related-Samples Wilcoxon Signed Rank test for baseline plaque index and final plaque index for *Salvadora persica* group.

Total N	Test statistic	Standard error	Standardised test statistic	p-value
21	<0.001	28.771	-4.015	<0.001

Null Hypothesis: The median of differences between Baseline Plaque index score and Final Plaque index (Day 21) equals 0. So, as Sig.a,b: <0.001, null hypothesis rejected.

in the means of the groups (Table 3). That did not significantly contribute to group distinction so, Tukey HSD technique was used to conduct multiple comparisons in order to find any significant differences in averages between the groups designated Group 1- CHX, 2- SP, and 3-Scaling. Test did not find any statistically significant differences between the means of the groups being compared (Table 4). All p-values were above the typical threshold of 0.05, indicating a lack of statistical significance.

Table 3: Intergroup comparison of mean difference in plaque index and gingival index at baseline and day 21 in three groups of Chlorhexidine, *Salvadora persica*, and Scaling.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	0.136	2	0.068	0.302	0.74

One way ANOVA.

Table 4: Comparison of mean difference of multiple groups - Chlorhexidine and *Salvadora persica*; *Salvadora persica* and Scaling; and Chlorhexidine and Scaling.

S .N.	Groups	Mean Difference (I-J)	Std. Error	p-value
1	(1) CHX	0.00962	0.14659	0.998
	(2) SP	-0.0935	0.14659	0.8
2	(2) SP	-0.1031	0.14659	0.762
	(3) Scaling	-0.0096	0.14659	0.998
3	(1) CHX	0.10314	0.14659	0.762
	(3) Scaling	0.09352	0.14659	0.8

Tukey HSD

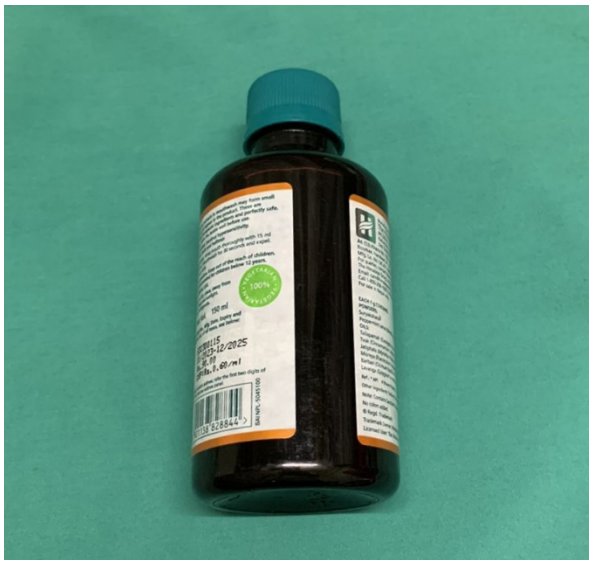

Figure1: Test agent *Salvadora persica* mouthwash.

Figure 2: Positive control chlorhexidine mouthwash.

DISCUSSION

The present study sought to evaluate the efficacy of three distinct interventions, namely CHX mouth rinse, *Salvadora persica* mouth rinse as an adjunct to Scaling and Scaling alone in the treatment of gingivitis. The assessment was based on Plaque Index and Gingival Index scores measured at baseline and day 21 of intervention. Participants encompassed a demographic range between 20 years to 50 years of age, all presenting with symptoms of gingivitis.

The results indicate that all three interventions (Chlorhexidine, *Salvadora persica* mouthwash as adjunct to Scaling, and Scaling alone) have demonstrated significant positive effects on gingival health observed by the improvements in PI and GI scores over the 21-day period.

These findings align with existing literature by Oak et al. (2023),[7] Mathew et al. (2022)[8] Adam et al. (2022),[9] Ramli et al. (2022),[10] Dizaye et al. (2020),[11] and Deshmukh et al. (2017)[12] which highlight the effectiveness of these interventions in managing the symptoms of gingivitis.

However, it was seen that there was no significant difference in the effectiveness of the three modalities. The findings of the some studies align with present study indicating that the use of herbal mouth rinse (Hiora) containing SP was found to be just as effective as a 0.12% CHX mouthrinse in reducing the average GI and PI scores among individuals with chronic gingivitis. [4,13]

In most of available literature, *Salvadora persica* mouth rinse has been found to be better than placebo but less efficient than CHX.[9,14]

However, in some studies *Salvadora persica* rinse was found to be more efficient and promising. [8,15,16] Whatever the result whether better or no better than CHX, use of those herbal rinses has been advocated pertaining to their fewer or no known adverse effects.

CHX mouthwash, a di-cationic biguanide is generally considered as an antimicrobial, antiplaque, and antigingivitis agent. The observed decrease in plaque accumulation and gingival irritation on day 21 in this study can be attributable to those properties and substantivity.[17] For this study, CHX (by Asian pharmaceuticals) at 0.2% concentration was used, as it is the one, which is readily available in the market. Also, duration of only one week was advised similar to other study by (Lee and Nam, 2022).[18] This is because; compliance is higher for short-term use. In addition, long-term use has been associated with several undesired side effects. Time duration of CHX mouth rinsing also seems important. In current study, participants were advised to use 10 ml 0.2% CHX for 60s, which has proven efficacy.[19,20]

Salvadora persica has also been extensively investigated in multiple studies, which have consistently shown that it possesses a diverse range of compounds that exhibit advantageous properties in the prevention of oral diseases.[21] Salvadorine, a natural chemical constituent found in this plant, exhibits a significant antibacterial effect.[22] With this knowledge, incorporating *Salvadora persica* is believed to further enhance the properties of the mouthwash.[23] In this study, Hiora mouthwash was used as herbal mouthwash containing *Salvadora persica* as it is a complete herbal mouth rinse that contains Bibhitaki, Nagavalli, Pilu, Peppermint satva, Yavani satva, Gandhapura taila, and Ela which are believed to exhibit antiplaque properties, inhibition of bacterial adherence to host tissues, and antibacterial properties.[24-25] Top of FormHere in this study, participants were advised to use *Salvadora persica* (Hiora) mouthwash 15 ml for 30 seconds as recommended by manufacturer.

The chemical plaque control methods are adjuncts to mechanical methods but cannot substitute those. Scaling and root planing, a mechanical intervention, focusses on the physical removal of plaque and calculus deposits from tooth and root surfaces. Scaling root planing remains gold standard treatment for periodontal diseases. Hence, in this study in one group only Scaling was performed without prescribing any mouth rinses.

The absence of statistically significant differences between the intervention groups suggests a comparable efficacy among the three approaches in treatment of gingivitis.

This means that, if Scaling is performed meticulously, it is enough to treat gingivitis. Adding chlorhexidine or *Salvadora persica* as adjuncts to scaling does

not yield additional benefits over scaling alone in gingivitis. However, in situations where optimum plaque control cannot be achieved by mechanical means, these mouth rinses hold great importance. As, the effectiveness of both mouthrinses were found to be comparable in this study, It can be recommend that herbal (*Salvadora persica*) mouthrinse is a good alternative to Chlorhexidine if chemical plaque control agent is to be prescribed.

The limitations of the study could be, chances of potential bias in allocation as standard randomisation was not done. As blinding could not be done in the study, ascertainment bias might have occurred. Since the study was done over a small sample from single centre, it cannot be taken as strong model. The relatively short intervention period of 21 days might not fully evaluate the long-term effectiveness of these interventions.

CONCLUSIONS

No one intervention demonstrated superiority over the others in terms of their impact on plaque accumulation and gingival inflammation. Further research with larger sample sizes or varied populations could provide more insight into potential subtle differences among these interventions, though current evidence implies that all three approaches are similarly effective in this context.

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