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Comparison of The Effects of Novel Green Tea and Chamomile Tea Combination Based Mouthwash Versus Chlorhexidine Mouthwash on Gingival Health: A Clinical Trial

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ABSTRACT:

Background: Given the limitations associated with Chlorhexidine (CHX), the quest for an effective and safe anti-plaque agent has spurred the development of alternative products. Recent advances in alternative medicine have led to the introduction of various new herbal alternatives for the treatment of gingivitis. The present study clinically evaluated the effect of a herbal mouthwash consisting of green tea and chamomile tea combination on periodontal indices.
Aim: The present study evaluated the comparative efficacy of novel herbal and CHX mouthwashes on the gingival health of healthy individuals.
Materials and Methods: The present study was a randomized parallel group controlled trial. A group of 30 healthy subjects in the age group of 18-40 years received complete supragingival scaling at baseline. Pre-operative clinical parameters, including Plaque Index (PI), Gingival Index (GI), Probing Depth (PPD), and Clinical Attachment Loss (CAL), were documented prior to oral prophylaxis and again two weeks after the procedure. Subjects were then randomly divided into the two groups (15 in each group) and were randomly intervened with the two different mouthwashes: novel herbal mouthwash and CHX mouthwash. Variables were again recorded on the 14th day after the use of mouthwashes, and data obtained were subjected to statistical analysis.
Results: There was no significant difference in the efficacy of novel herbal mouthwash and CHX mouthwash on plaque accumulation, gingival health, and oral hygiene status.
Conclusion: Herbal mouthwashes can prove to be effective alternatives to CHX with fewer side effects**.**

Keywords: Dental plaque, Gingivitis, Herbal mouthwash, Periodontitis

1. Introduction

The two most common dental diseases, dental caries and periodontal diseases, are caused by dental plaque, a complex microbial community (1). Therefore, plaque control should be an essential part of everyone's daily routine, as regular and thorough plaque removal can primarily prevent the onset of dental diseases(2). Mechanical plaque control can be achieved through proper tooth brushing techniques using a toothbrush and interdental aids. While proper tooth-brushing is effective for plaque control, mechanical plaque control methods have inherent limitations(3). The effectiveness of tooth brushing is influenced by factors such as dexterity and individual motivation. Dental plaque is composed of numerous living microorganisms attached to an extracellular matrix(4). Although dental plaque biofilm cannot be permanently eliminated, its pathogenic nature can be mitigated by reducing the total microbial load(5). Therefore, adjunctive chemical plaque control methods, such as varnishes, dentifrices, and mouthwashes, have been suggested as an additional therapeutic strategy to enhance, but not replace, mechanical plaque control (6,7). Mouthwash supplements routine mechanical oral hygiene procedures in controlling supragingival plaque formation and are used to improve oral health care. The use of mouthwash affects both the bacterial and plaque growth. Bacterial

adhesion, colonization, and metabolic activity are inhibited using mouthwashes.
Due to its multifactorial etiology and complex disease process, the treatment of periodontitis remains a challenging task for dentists. Consequently, herbal remedies, such as triphala mouthwash and Hiora mouthwash, have been utilized to provide antimicrobial, antioxidant, and anti-inflammatory effects(8,9). Apart from these many medicinal plants such as chamomile tea and green tea are being utilised as alternatives to chlorhexidine mouthwashes due to their superior properties(10). Given the variety of mouthwashes with different active ingredients available, both patients and practitioners often face a dilemma regarding which one to choose(11). Although CHX is widely regarded as the most effective anti-plaque agent, it does come with certain limitations (12). Chlorhexidine gluconate has a broad spectrum of antibacterial effect because of its bactericidal and bacteriostatic activity and its high oral substantivity. Chlorhexidine is unpleasant in taste and alters taste sensation. Chlorhexidine is non-toxic but affects the mucous membrane, tongue, and causes brown stains on the teeth(13).

Hence, the search for an effective and safe alternative to CHX mouthwash has led to the introduction of various herbal products in dentistry(14). These herbal products are not only free from major side effects but are also affordable and readily available(15). When used in mouthwashes, natural herbs have shown significant advantages over chemical alternatives(16). Therefore, this study was designed to compare the effectiveness of herbal chamomile and green tea combination based mouthwashe with that of CHX on plaque accumulation by assessing various periodontal parameters.

2. Materials and Methods

The present study was a randomized controlled trial with two parallel groups. Ethical clearance was obtained from the Institutional Ethical Committee of Saveetha Dental College and Hospital, Chennai, India, IHEC number IHEC/SDC/PERIO-2105/23/055. Two different mouthwashes were used: Hexidine mouthwash containing 0.2% chlorhexidine gluconate (ICPA Health Products Ltd.) and novel formulated herbal mouthwash, prepared according to Chatterjee et al(17). A total of 30 healthy subjects were recruited for the study. The sample size of 30 was calculated using G*Power software.

Inclusion criteria: Systemically healthy subjects aged 18-40 years willing to comply with the study visits, were included.

Exclusion criteria: Subjects with malaligned teeth, wearing orthodontic appliances and removable partial dentures, those with chronic or aggressive periodontitis, those who had undergone oral prophylaxis within the past six months, tobacco users and smokers, those on antibiotic therapy in the past three months, and those with medical or pharmacological histories that could compromise the study were excluded.
The 30 subjects were divided into two groups of 15 each (Groups A and B), with each group randomly assigned one mouthwash via a lottery method.
Group allocation:Group A rinsed with 15 ml of novel (herbal) mouthwash for 60 seconds twice daily, 30 minutes after tooth brushing for 14 days, then spit it out. Group B rinsed with 10 ml of Hexidine mouthwash for 60 seconds twice daily, 30 minutes after tooth brushing for 14 days, then spit it out. Subjects were instructed not to eat or drink anything for the next half hour to achieve the mouthwash's effect.

All subjects received complete supragingival scaling to remove all plaque, stains, and calculus at baseline. They were provided with the same brand of toothbrushes and toothpaste to

eliminate confounding bias. Subjects were instructed to stop using the mouthwashes and report immediately if they experienced any side effects. They were also instructed to brush twice daily with the given toothbrush and toothpaste. All subjects were asked to report to the department on the 14th days for recording variables, PI, GI, PPD and CAL were documented prior to oral prophylaxis and again two weeks after the procedure.

Statistical Analysis

The data obtained was subjected to statistical analysis using SPSS 17.0. Depending upon the nature of data, chi square test was applied for categorical data and ANOVA was applied to test continuous data. Significance was assessed at 5% level of significance ($p<0.05$).

3. Results

The study sample consisted of 30 patients, 15 patients in each group A and B respectively.

Intragroup Comparison

Group A

The mean Plaque Index (PI) before interventions was 2.37±0.59, which decreased to 1.79±0.57 after intervention. The mean Gingival Index (GI) before intervention was 1.44±0.24, reducing to 1.17±0.14 post-intervention. The mean Clinical Attachment Loss (CAL) pre-operatively was 0.78±0.22, and it decreased to 0.61±0.36 post-operatively. The mean Probing Depth (PD) before interventions was 1.32±0.34, which lowered to 1.13±0.16 after interventions.

Group B

The mean pre-operative Plaque Index (PI) was 1.74±0.31, and it decreased to 1.52±0.26 post-operatively. The mean pre-operative Gingival Index (GI) was 1.63±0.20, slightly reducing to 1.55±0.19 after interventions. The mean Clinical Attachment Loss (CAL) pre-operatively was 0.77±0.45, and it improved to 0.61±0.29 post-operatively. The mean Probing Depth (PD) before interventions was 1.37±0.39, which reduced to 1.01±0.28 post-operatively.

The pre and post-operative values of variables recorded for Groups A and B are as shown in Table 1 and 2 respectively.

Parameter	Group A	Group B	P value
PI	2.37±0.59	1.74±0.31	0.03
GI	1.44±0.24	1.63±0.20	0.56
PPD	1.32±0.34	1.37±0.39	0.69
CAL	0.78±0.22	0.77±0.45	0.71

Table 1. Pre-operative mean values of PI, GI, PPD and CAL in Groups A and B respectively

Parameter	Group A	Group B	P value
PI	1.79±0.57	1.52±0.26	0.41
GI	1.17±0.14	1.55±0.19	0.55
PPD	1.13±0.16	1.01±0.28	0.32
CAL	0.61±0.36	0.61±0.29	0.56

Table 2. Post-operative mean values of PI, GI, PPD and CAL in Groups A and B respectively

Intergroup Comparison (Group A and Group B)

An intergroup comparison was conducted between Group A (novel herbal mouthwash) and Group B (chlorhexidine mouthwash) to evaluate the clinical outcomes of the two treatments.

The analysis showed a statistically significant difference in the mean values of Plaque Index (PI) (0.02) and Gingival Index (GI) (0.01), as well as in Clinical Attachment Loss (CAL) and Probing Depth (PD) between the two experimental groups. However, no significant differences were observed before and after the therapeutic interventions as shown in table 3.

Parameter	Mean ± SD	P value
Pre PI		0.03
Group A	2.37±0.59	
Group B	1.79±0.57	
Pre GI		NS
Group A	1.44±0.24	
Group B	1.63±0.20	
Pre PPD		NS
Group A	5.09±0.78	
Group B	5.43±0.88	
Pre CAL		NS
Group A	0.78±0.22	
Group B	0.77±0.45	
Post PI		0.02
Group A	1.79±0.57	
Group B	1.52±0.26	
Post GI		0.01
Group A	1.17±0.14	
Group B	1.55±0.19	
Post PPD		NS
Group A	1.13±0.16	
Group B	1.01±0.28	
Post CAL		NS
Group A	0.61±0.36	
Group B	0.61±0.29	

Table 3. The comparison of pre-operative and postoperative mean values of PI, GI, CAL and PD in Groups A and B. (NS: Non-Significant)

4. Discussion

The removal of dental biofilm is a crucial aspect of treating periodontal disease(18). This can be successfully achieved through both mechanical and chemical methods of plaque control. As

an adjunct to mechanical plaque control, such as toothbrushing, many chemical antiplaque agents are also effective, especially when used in combination with mechanical aids. According to some in vitro microbiological studies, antimicrobial agents can penetrate bacterial biofilm and exert their bactericidal properties. Additionally, chemical agents can reach interproximal areas that are difficult to clean and inhibit bacterial growth and subsequent biofilm formation on soft tissues. The application of these chemical agents is safe and does not appear to contribute to the development of resistant species.

Mouthwashes are convenient chemical agents for biofilm control. Chlorhexidine is considered the "gold standard" antiplaque mouthwash due to its prolonged broad-spectrum antimicrobial activity and inhibitory effect on biofilm(19). It also exhibits excellent antiplaque activity and prolonged substantivity(20). Chlorhexidine is effective against a wide range of Gram-positive and Gram-negative organisms, fungi, facultative anaerobes, and aerobes. Gram-positive cocci, particularly Streptococcus mutans, are especially sensitive to chlorhexidine, which works by binding to the bacterial cell wall and disrupting its function.
This study reported a significant reduction in plaque scores in the group using chlorhexidine, consistent with other studies demonstrating similar effects of chlorhexidine mouthwash on plaque scores(21). The use of chlorhexidine mouthwash results in the inhibition of bacterial accumulation(22).
A similar study was conducted to compare the antiplaque efficacy of herbal and chlorhexidine gluconate mouthwash, reporting no significant difference in the gingival index and plaque index scores(23). Another study utilized a 2-week experimental gingivitis model and demonstrated that mouthwashes containing essential oils had superior anti-plaque and anti-gingivitis properties compared to those containing cetylpyridinium chloride(24). An in vitro comparative study evaluated the efficacy of chlorhexidine and a herbal mouthwash on dental plaque. Twenty plaque samples collected from periodontitis patients and healthy patients were streaked on blood agar. The well diffusion method was used to compare chlorhexidine gluconate, herbal mouthwash, and normal saline. These were then incubated at 37°C for 24 hours and examined for zones of inhibition. The study concluded that both the herbal and chlorhexidine mouthwashes were equally effective in vitro, suggesting that the herbal mouthwash could be used therapeutically in the future to inhibit oral microbial growth(25).

In another study involving 90 patients divided into three groups (Normal saline group, Chlorhexidine group, and Hiora mouthwash group), it was found that both Chlorhexidine and Hiora mouthwash were superior to normal saline. However, there was no significant difference between the Chlorhexidine and Hiora groups(26). Additionally, a study comparing the efficacy of a commercially available herbal mouthwash (HiOra) with an essential oil-containing mouthwash (Listerine) concluded that both mouthwashes yielded comparable results in plaque reduction, underscoring the potential of herbal mouthwash as an effective antiplaque agent(27).

Chlorhexidine and other antimicrobials are also administered through local drug delivery systems. These can be delivered in forms such as gels or microchips, which release the ingredients directly into the gingival sulcus for effective plaque reduction . Nanotechnology has been utilized in the delivery of antimicrobial agents for more effective treatment . Long-term cohort studies are necessary to evaluate the effectiveness of these antimicrobial agents(28).

Limitations

A cross-over design with wash-out period could have been a more valid study design as it eliminates the bias of variable host response.

5. Conclusion

The results of this study conclude that both Chlorhexidine and novel herbal chamomile and green tea based mouthwashes are equally effective in treating gingivitis when used as an adjunct to mechanical plaque control. No statistically significant difference was observed between the two groups. However, due to lesser side effects associated with herbal mouthwash, it could prove to be a valuable alternative to Chlorhexidine.

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