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A Clinical Comparison of Green Tea Mouthrinse and a Xylitol Containing Chewing Gum in Managing Dental Plaque

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Abstract: Dental plaque serves as a favorable environment for the etiology of periodontal diseases. Consequently, effective plaque control is essential for the prevention and management of these oral health conditions. Research has demonstrated that xylitol-containing chewing gums have been shown to have greater plaque removing particularly in individuals with poor oral hygiene, when compared to conventional chewing gums. The present study aimed to evaluate the effects of xylitol containing chewing gum in plaque removal and compare its clinical efficacy with that of a green tea-based mouthrinse. A randomized, crossover clinical trial involving 24 participants, randomly allocated into two groups. Participants in Group 1 were instructed to chew the test gum for 15 minutes, twice daily, while those in Group 2 used a green tea mouthrinse with the same frequency. Following a 14-day intervention period, clinical parameters—including the O'Leary PI, GI, and Sulcus Bleeding Index—were assessed. All subjects then received professional tooth cleaning, and a 14-day washout period was observed. Subsequently, the interventions were crossed over between the two groups, and the same clinical parameters were re-evaluated at the conclusion of the second 14-day period. There were no statistically significant differences between the two groups in terms of age or sex distribution. Paired sample t-test analysis revealed statistically significant reductions in all clinical indices in Group 2 ($P < 0.05$). In contrast, no statistically significant changes were observed in Group 1 across the two study periods. Furthermore, independent sample t-tests demonstrated no significant differences between the two groups at baseline, after the first intervention, or following the second intervention for any of the evaluated indices ($P > 0.05$). The green tea mouthrinse demonstrated clinical outcomes comparable to those of the xylitol containing chewing gum in terms of reducing dental plaque and improving gingival health. Given its effectiveness, accessibility, and user compliance, this green tea mouthrinse may be considered a viable adjunct for chemical plaque control in routine oral hygiene practices.

Keywords: *Dental Plaque, Plaque Control, Xylitol Chewing Gum, Green Tea Mouthrinse.*

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I. INTRODUCTION

Dental biofilms play a critical biological role in supporting the growth, survival, and activity of pathogenic microorganisms responsible for periodontal diseases and dental caries.[1] These complex microbial communities adhere to tooth surfaces and the gingival margin, creating a protective environment that facilitates the persistence of harmful bacteria. Consequently, the effective disruption and removal of the biofilm layer are essential components in the prevention and management of these oral health conditions.[2]

There is substantial evidence supporting the effectiveness of both mechanical and chemical methods for plaque control. Common mechanical aids such as the toothbrush, dentifrice (toothpaste), dental floss, and

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interdental brushes, along with chemical agents like mouthwashes, play a critical role in maintaining oral hygiene. These methods collectively emphasize that the thorough removal of bacterial plaque is the most effective strategy for preventing periodontal diseases. Consistent and proper use of these plaque control measures is essential for long-term oral health.[3,4]

In recent years, chewing gums have gained attention for their effectiveness in controlling dental caries and plaque control.[5-6]Beyond the mechanical action of chewing gums, xylitol offers additional therapeutic benefits. Xylitol, a natural sugar alcohol, possesses bacteriostatic properties that inhibit the growth and adherence of bacteria, thereby reducing plaque formation. Furthermore, xylitol stimulates salivary flow, which helps to neutralize acids, and support remineralization of the enamel. Together, these effects contribute significantly to improved oral health and the prevention of dental diseases.[7]

Green tea has shown promising results in controlling dental plaque. Its use as a mouth rinse has been found to improve plaque and bleeding indices, while also reducing IL-1β, a pro-inflammatory cytokine. This suggests that green tea could be a safe adjunct in managing gingival inflammation. Unlike other teas, green tea undergoes minimal fermentation, preserving its beneficial compounds. Its polyphenols offer antioxidant, anti-inflammatory, antibacterial, antiviral, antimutagenic, antidiabetic, and cancer-preventive effects, making it valuable in preventing periodontal and other oral diseases.[8-9]

➢ *Aim & Objective:*

This study investigates the effect of green tea mouthrinse on plaque control and compares its efficacy with xylitol containing chewing gum.

II. METHODOLOGY

➢ *Study Design*

This study is an interventional and cross-over clinical trial. The study protocol was approved by the institutional ethics committee.

In the present study, Twenty-four patients with moderate gingivitis who presented to the Department of Periodontology were recruited for the study. Informed consent was obtained from all participants prior to enrollment, patients signed consent forms.

Individuals aged 20-40 years, with >20 teeth present,having no systemic diseases, having no periodontal disease and having O'leary plaque index of above 50%were included in this study.

Smokers, pregnant & lactating females, subjects with history of antibiotic or anti-inflammatory drugs within past 6 months, any systemic diseases or any inflammatory conditions other than gingivitis and participants were asked not to take xylitol-chewing gumduring the study period oradding any oral hygiene routine or need to any additional dental procedures were excluded.

At baseline, the following clinical parameters were recorded for each patient: O'Leary Plaque Index, Gingival Index, and Sulcus Bleeding Index.

All participants then underwent scaling and root planing (SRP) with polishing. Following this initial treatment, the subjects were randomly assigned into two groups, with twelve patients in each group.

- Group 1Xylitol containing chewing gum should be chewed twice a day for 15 minutes after eating.
- Group 2utilized green tea mouthrinse two times a day, dissolve the tablet into a glass of water, rinse around teeth & gums for 30 seconds, then spit out.

Fig 1 Xylitol Containing Chewing Gum

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Fig 2 Green Tea Mouthrinse

Patients were recalled after 14 days. At this visit, the Plaque Index, Gingival Index, and Sulcus Bleeding Index were reassessed and recorded using standardized forms. Scaling and root planing (SRP) along with polishing were repeated for all patients.

Following this, a two-week washout period was observed during which the participants refrained from using any of the previously prescribed plaque control methods. After the washout period, the assisted plaque control interventions for the two groups were modified as follows:

- Group 1used green teamouthrinse twice a day. (dissolve the tablet into a glass of water, rinse around teeth & gums for 30 seconds, then spit out)
- Group 2ChewedXylitol containing chewing gum twice a day for 15 minutes after eating.

The plaque, gingival, and sulcus bleeding indices were re-collected for each patient after 14 days in the record forms, and the obtained data were compared to previous data. The effective tooth brushing and plaque control methods were instructed to the patients.

➢ *Statistical Analysis*

The data collected was subjected to statistical analysis using SPSS (Statistical Package for Social Sciences) version 26. A paired t-test was carried out to compare the data at baseline, 14 days & 28 days & all the $P < 0.05$ was considered to be statistically significant.

III. RESULTS

Table 1 The Comparative Results of the Mean O'leary Plaque Index at Baseline and after 14 and 28 Days.

Index	Group	Baseline (day 0)	After 14 days (duration 1)	After 28 days (After the wash-out period) (duration 2)	A paired t-test comparison between duration 1 & 2 (P - value)
O'leary plaque index	Group 1 (Chewing gum-mouthrinse)	3.37 ± 0.63	3.14 ± 0.51	3.00 ± 0.41	0.378
	Group 2 (Mouthrinse-Chewing gum)	3.36 ± 0.54	2.95 ± 0.64	2.83 ± 0.67	0.005
	Independent t – test (P – value)	0.48	0.17	0.29	

In Group 1, the mean O'Leary plaque index showed no statistically significant change between the first and second periods ($p = 0.378$). In contrast, Group 2 demonstrated a significant reduction in the mean plaque index scores across the same intervals ($p = 0.005$), with the green tea mouthrinse proving to be most effective in reducing plaque.

Table 2 The Comparative Results of the Mean Gingival Index at Baseline and after 14 and 28 Days.

Index	Group	Baseline (day 0)	After 14 days (duration 1)	After 28 days (After the wash-out period) (duration 2)	A paired t-test comparison between duration 1 & 2 (P – value)
Gingival index	Group 1 (Chewing gum-mouthrinse)	1.28 ± 1.02	1.16 ± 1.17	1.14 ± 0.15	0.5
	Group 2 (Mouthrinse-Chewing gum)	1.29 ± 0.18	1.06 ± 0.12	1.07 ± 0.16	< 0.001
	Independent t-test (P – value)	0.96	0.674	0.05	

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There was no significant difference in the mean gingival index of Group 1 between the first and second duration (p = 0.5). However, in Group 2, a significant difference was observed between the first and second duration (p < 0.001), with the green tea mouthrinse demonstrating the highest effectiveness.

Table 3 The Comparative Results of the Mean Sulcus Bleeding Index at Baseline and after 14 and 28 Days.

Index	Group	Baseline (day 0)	After 14 days (duration1)	After 28 days (After the wash-out period) (duration 2)	A paired t-test comparison between duration 1 & 2 (P – value)
Sulcus bleeding index	Group 1 (Chewing gum-mouthrinse)	0.44 ± 0.23	0.27 ± 0.21	0.25 ± 0.20	0.003
	Group 2 (Mouthrinse-Chewing gum)	0.47 ± 0.22	0.18 ± 0.16	0.17 ± 0.13	< 0.001
	Independent t-test (P – value)	0.679	0.1	0.095	

Results found a significant difference in the mean sulcus bleeding index of group 1 between the first and second duration with p value 0.003. Howeverin the group 2there was highly significant difference between the first and second duration regarding the mean sulcus bleeding index with p value < 0.001and the group 2 treatmentshowed the highest effectiveness.

IV. DISCUSSION

In present study, subgroup analysis based on treatment type showed no significant differences between the two groups in the O'Leary plaque index, gingival index, or sulcus bleeding index. These findings indicate that the green tea mouthrinse was comparable to the xylitol-containing gum in reducing plaque accumulation, gingival inflammation, and bleeding. In recent years, periodontal therapy has evolved substantially; however, non-surgical approaches remain the foundation of treatment, aiming to control bacterial plaque and support tissue healing. Increasingly, herbal extracts are being incorporated into these therapies to enhance oral tissue regeneration and strengthen the body's natural defense mechanisms.[10]

The obtained results, relating to plaque index improvement and decreased bleeding, were consistent with the results of previous studies conducted by Krahwinkel and Willershausen[11] using green tea candies, as a distinct improvement in both approximal plaque index (API) and sulcus bleeding index(SBI) values could be stated in individuals using green tea extracts. The results indicate that the oral application of green tea catechins and polyphenols might have a positive influence on the inflammatory reaction of periodontal structures.

Recently, Xylitol-containing chewing gums have found application as an efficient plaque control method in patients.[7]In the Keukenmeester et al. studysimilar decreases in the amount of plaque were observed in the group using xylitol containing chewing gum.[12] In circumstances where regular brushing is performed, no effect of chewing gum was observed on bleeding and plaque scores. In the absence of brushing, xylitol chewing gum provided a significant inhibitory effect on gingivitis scores. The difference when compared to the group not using gum was shown in terms of reduced bleeding on marginal probing (BOMP) & reduced plaque scores in individuals using xylitol chewing gum.

Green tea mouthrinse was superior in reducing dental plaque formation, as seen by the significant decrease in dental plaque production observed in Group 2 (mouthrinse-gum formulation),according to the results of the O'Leary Plaque Indexanalysis.

On the other hand, there was no discernible difference in Group 1 (gum formulation-mouthrinse). According to this study's findings, the green tea mouthrinse reduces plaque equally in comparison to xylitol containing gum formulation.The Gingival & Sulcus Bleeding Indices showed a similar pattern. Overall, there were no statistically significant differences in the improvement of the Sulcus Bleeding indices, Gingival indices, or O'Leary Plaque indices between thetwo treatments. On the other hand,green tea mouthrinse showed similar efficacy to the xylitol containing gum formulation. This same effectiveness is a significant accomplishment because the green tea mouthrinse does not have the possible negative effects of xylitol containing gum formulation.

V. CONCLUSIONS

The findings of this study suggest that the green tea mouthrinse is comparably effective to xylitol containing gum formulation in reducing dental plaque and improving gingival indices. Consequently, this green tea mouthrinse may be considered an effective, affordable, and accessible option for plaque control and could be recommended as part of a daily oral hygiene routine.

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