



Plaque-Disclosing Tablets as An Adjunct for Plaque Control in Moderate to Severe Gingivitis: A Clinical Trial.

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ABSTRACT:

Introduction: Dental plaque is a structured microbial biofilm that adheres to tooth surfaces and is the primary cause of gingivitis and periodontal disease. If not effectively removed, it triggers gingival inflammation that may progress from reversible gingivitis to irreversible periodontitis with attachment and bone loss. Although conventional oral hygiene instructions are widely used, patients often overestimate their plaque removal, limiting long-term effectiveness. Plaque-disclosing tablets offer a simple, cost-effective adjunct by staining plaque and providing immediate visual feedback, thereby enhancing patient awareness, motivation, self-monitoring, and overall plaque control.

Objectives: This investigation sought to evaluate the effects of plaque-disclosing tablets (PDTs) on the oral health status of patients with gingivitis, focusing on plaque and gingival index scores.

Methods: The study consisted of two groups: Group A (n=49), which received standard oral hygiene instructions, and Group B (n=50), which received enhanced motivation using plaque-disclosing tablets (PDTs) in the dentist's office, supplemented with at-home use of disclosing tablets along with conventional oral hygiene instructions. The periodontal parameters were recorded at the first visit (T0) and after first month of usage of plaque disclosing tablets (T1).

Results: The plaque index (PI) scores of group B were significantly lower ($p < 0.05$), when compared to groups A, after the first (T1) months; however, no significant differences ($p > 0.05$) were found regarding gingival index between groups A and B. The gingival status of group B did not change significantly ($p > 0.05$) over the period of 1 month and was statistically lower when compared to groups A.

Conclusions: The at-home use of PDTs can potentially enhance oral health outcomes by facilitating self-examination, leading to more efficient plaque removal and improved gingival health stability.

1. Introduction

Dental plaque is a structurally and functionally organized biofilm composed predominantly of bacteria embedded in an extracellular matrix that adheres firmly to tooth surfaces and gingival margins. It plays a central role in the initiation and progression of gingivitis and periodontal diseases [1,2]. The dynamic interaction between microbial biofilms and the host immune response determines whether periodontal tissues remain

healthy or progress toward inflammation and destruction [3]. When plaque is not effectively disrupted through regular oral hygiene practices, pathogenic microorganisms proliferate, triggering an inflammatory cascade in the gingival tissues. Clinically, this manifests as gingival redness, edema, bleeding on probing, and, if unresolved, may advance to periodontal attachment loss and alveolar bone resorption [4].



Gingivitis represents the earliest and most common form of periodontal disease. Importantly, it is a reversible condition provided adequate plaque control measures are instituted in a timely manner [5]. However, persistent gingival inflammation due to inadequate oral hygiene can lead to periodontitis, a chronic inflammatory condition with irreversible tissue destruction and significant implications for oral and systemic health [6]. Therefore, effective plaque control remains the cornerstone of both prevention and management of gingival and periodontal diseases.

Traditional oral hygiene education primarily relies on verbal instructions or written pamphlets explaining brushing and flossing techniques. Although such methods are widely used, their effectiveness in producing sustained behavioral change is often limited [7]. Several studies have reported that patients frequently overestimate the adequacy of their oral hygiene practices, resulting in persistent plaque accumulation despite receiving standard instructions [8]. This gap between knowledge and practice underscores the need for innovative educational strategies that enhance patient motivation, awareness, and self-efficacy.

In recent years, patient-centered approaches emphasizing motivation, self-monitoring, and visual feedback have gained prominence in preventive dentistry [9]. Visual aids, including diagrams, intraoral photographs, and plaque-disclosing agents, provide tangible evidence of oral hygiene status and have been shown to improve patient engagement [10]. Among these tools, plaque-disclosing tablets are inexpensive, easy to use, and effective in staining dental plaque, thereby making otherwise invisible biofilm clearly visible to patients [11].

Plaque-disclosing agents work by selectively staining plaque deposits, allowing both clinicians and patients to identify areas that are frequently missed during routine brushing [12]. Their use not only facilitates targeted oral hygiene instruction but also reinforces learning through immediate visual feedback. When used regularly at home, plaque-disclosing tablets may function as a self-assessment tool, enabling patients to evaluate their brushing effectiveness and modify their technique accordingly [13].

Despite their widespread use in dental education and chairside motivation, evidence regarding the sustained clinical impact of regular at-home plaque-disclosing

tablet use on periodontal parameters remains limited. Most studies focus on short-term plaque reduction or educational outcomes, with fewer investigations evaluating their effect on both plaque accumulation and gingival inflammation over time [14]. Hence, the present study was designed to assess the effectiveness of plaque-disclosing tablets as a motivational and self-monitoring adjunct by comparing plaque index and gingival index scores in patients with gingivitis over a one-month period.

2. Methods

This randomized interventional study was conducted to evaluate the effect of plaque-disclosing tablets (PDTs) on plaque control and gingival health among individuals diagnosed with gingivitis. A total of 100 participants attending the outpatient department were recruited after obtaining informed consent. Ethical approval was secured prior to study initiation, and the study was conducted in accordance with the Declaration of Helsinki.

Participants were randomly allocated into two groups using a simple randomization method. Group A (control group) consisted of 49 participants who received conventional oral hygiene instructions, including brushing twice daily using a fluoridated toothpaste and daily flossing. Group B (test group) included 50 participants who received the same oral hygiene instructions along with the use of plaque-disclosing tablets for motivational and self-assessment purposes. One participant from Group A was lost to follow-up, resulting in a final sample size of 99.

Inclusion criteria were individuals aged 18–40 years, systemically healthy, diagnosed with mild to moderate gingivitis, and having at least 20 natural teeth. Exclusion criteria included systemic conditions known to influence periodontal health, use of antibiotics or anti-inflammatory drugs in the preceding three months, periodontal therapy within the past six months, tobacco use in any form, pregnancy or lactation, allergy to disclosing agents, and non-compliance with study instructions.

Clinical assessments were performed using standardized periodontal indices. The Plaque Index (Silness and Løe) was used to quantify plaque accumulation on selected tooth surfaces, with scores ranging from 0 to 3 [12]. The Gingival Index (Løe and Silness) was employed to assess gingival inflammation, with scores ranging from healthy



gingiva to severe inflammation with spontaneous bleeding [13]. All examinations were conducted by a single calibrated examiner to minimize inter-examiner variability.

Baseline measurements (T0) were recorded prior to intervention, and follow-up assessments were conducted after one month (T1). Participants in Group B were instructed to use plaque-disclosing tablets twice daily before brushing and to record their usage in a provided logbook. Visual aids and reinforcement instructions were also given to enhance compliance and technique accuracy.

Data were compiled using Microsoft Excel and analyzed using SPSS. Descriptive statistics, including means and standard deviations, were calculated for plaque and gingival indices. The Shapiro–Wilk test confirmed normal data distribution, permitting the use of parametric tests. Paired t-tests were used for intra-group comparisons between baseline and one-month scores, while independent t-tests were used for inter-group comparisons. Statistical significance was set at $p \leq 0.05$.

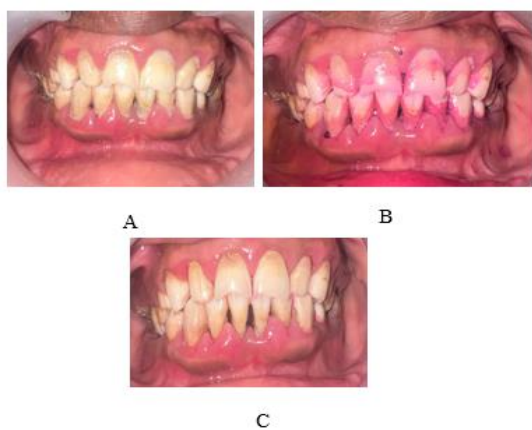


Fig -1

Fig 1:-A- Baseline: An invisible plaque (biofilm) is present. B-Disclosed:After using a plaque disclosing tablet (PDT), plaque stains bright pink/magenta, highlighting missed brushing areas. Image C-Post-Cleaning: , In home and at office usage of PDT ,Stained plaque is brushed away, showing a clean, plaque-free surface after follow up

3. Results

Baseline plaque index and gingival index scores were comparable between Group A and Group B, indicating homogeneity of the study population at baseline and confirming the effectiveness of the randomization

process. The absence of statistically significant differences at baseline ensured that changes observed at the one-month follow-up could be attributed to the intervention rather than pre-existing variations between the groups.

At the one-month follow-up, inter-group comparison revealed a statistically significant reduction in mean plaque index scores in Group B compared to Group A (Table 1). While both groups demonstrated a reduction in plaque scores over time, Group B exhibited a lower mean plaque index (0.91 ± 0.39) than Group A (0.98 ± 0.27), indicating superior plaque control among participants who used plaque-disclosing tablets in addition to conventional oral hygiene instructions.

Intra-group analysis of plaque index scores showed a marginal reduction from baseline to one month in both groups (Table 2). In Group A, the reduction was not statistically significant ($p = 0.579$). Similarly, although Group B demonstrated a greater numerical reduction in plaque index, the change did not reach statistical significance ($p = 0.051$). Despite the lack of statistical significance, the downward trend observed in Group B suggests a clinically relevant improvement that may become significant with a longer duration of follow-up, increased reinforcement, or sustained compliance.

Inter-group comparison of gingival index scores demonstrated no statistically significant differences between Group A and Group B at baseline or after one month (Table 3). Although both groups showed a slight reduction in gingival index scores at the follow-up examination, the difference between the groups remained non-significant ($p = 0.176$).

Intra-group comparison of gingival index scores further revealed that the reductions observed within both groups from baseline to one month were minimal and not statistically significant (Table 4). Group A showed a decrease from 1.28 ± 0.37 to 1.24 ± 0.12 ($p = 0.791$), while Group B demonstrated a reduction from 1.26 ± 0.29 to 1.23 ± 0.25 ($p = 0.696$).

Overall, the results indicate that the use of plaque-disclosing tablets resulted in a significant improvement in plaque control over a short-term period, whereas changes in gingival inflammation were limited. This suggests that while plaque-disclosing tablets are effective in enhancing plaque removal, a longer duration of sustained plaque control may be required to achieve measurable



improvements in gingival health.

Table 1: Inter group comparison of plaque index among study groups

Time intervals	Groups	Mean±Std.dev	p-value
At 1 st visit	Group A(n=49)	1.01±0.45	0.741
	Group B(n=50)	0.97±0.32	
After 1 month	Group A (n=49)	0.98±0.27	0.038*
	Group B(n=50)	0.91±0.39	

Independent sample t test; p-value ≤ 0.05 is statistically significant; * denotes significance

Table 1 describes the inter group comparison of plaque index among the study groups using independent sample t test. At 1 visit, group A had slightly higher score of plaque index when compared to group B and this difference is not statistically significant ($p=0.741$). after 1 month, group B had lesser score of plaque index when compared to group A and this difference is statistically significant ($p=0.038$).

Table 2: intra group comparison of plaque index among study group

Groups	Time intervals	Mean ±Std.dev	p-value
Group A	At 1 st visit (n=49)	1.01±0.45	0.579
	After 1 month(n=49)	0.98±0.27	
Group B	At 1 st visit (n=50)	0.97±0.32	0.051
	After 1 month(n=50)	0.91±0.39	

Paired t test; p-value ≤ 0.05 is statistically significant; * denotes significance

Table 2 describes the intra group comparison of plaque index among the study groups using paired t test. In group A, plaque index at 1st visit had slightly higher score when compared to plaque index after 1 month and this difference is not statistically significant ($p=0.579$).

in group B, plaque index at 1 visit had higher score when compared to plaque index after 1 month and this difference is also statistically not significant ($p=0.051$).

Table 3: Inter group comparison of gingival index among study groups

Time intervals	Groups	Mean ±Std.dev	p-value
At 1 st visit	Group A(n=49)	1.28±0.37	0.874
	Group B (n=50)	1.26±0.29	
After 1 month	Group A(n=49)	1.24±0.12	0.176
	Group B (n=50)	1.23±0.25	

Independent sample t test; p-value ≤ 0.05 is statistically significant; * denotes significance

Table 3 describes the inter group comparison of gingival index among the study groups using independent sample t test. At 1 visit, group A had slightly higher score of gingival index when compared to group B and this difference is not statistically significant ($p=0.874$). after 1 month, group B had slightly lesser score of gingival index when compared to group A and this difference is statistically significant ($p=0.176$).

Table 4:Intra group comparison of gingival index among study group

Groups	Time intervals	Mean ±Std.dev	p-value
Group A	At 1 st visit (n=49)	1.28±0.37	0.791
	After 1 month(n=50)	1.24±0.12	
Group B	At 1 st visit (n=49)	1.26±0.29	0.696
	After 1 month(n=50)	1.23±0.25	

Paired t test; p-value ≤ 0.05 is statistically significant; * denotes significance

Table 4 describes the intra group comparison of gingival index among the study groups using paired t test. In group A, gingival index at 1st visit had slightly higher



score when compared to gingival index after 1 month and this difference is not statistically significant ($p=0.791$). In group B, gingival index at 1 visit had higher score when compared to gingival index after 1 month and this difference is also statistically not significant ($p=0.696$).

4. Discussion

The present study assessed the role of plaque-disclosing tablets as an adjunctive motivational tool in improving plaque control and gingival health among patients with gingivitis. The statistically significant intergroup reduction in plaque index observed in the test group highlights the positive influence of visual feedback on patient behavior and oral hygiene performance [9,10,14]. Visual feedback tools such as plaque-disclosing tablets transform an abstract concept—dental plaque—into a clearly visible and tangible entity, thereby increasing patient awareness of plaque accumulation and its distribution. This heightened awareness plays a crucial role in reinforcing oral hygiene instructions and translating knowledge into effective daily practice.

Visual identification of plaque enables patients to recognize areas that are frequently neglected during routine brushing, particularly along the gingival margins, interproximal surfaces, and posterior teeth [15]. By revealing these problem areas, plaque-disclosing tablets encourage patients to modify brushing techniques, increase brushing duration, and adopt more systematic cleaning approaches. This immediate cause-and-effect feedback mechanism has been shown to enhance motivation, accountability, and self-efficacy, all of which are essential components of sustained behavioral change in preventive dentistry. The improvement observed in plaque scores in the present study supports the concept that patient involvement and self-monitoring significantly influence oral hygiene outcomes.

Despite the improvement in plaque control, gingival index scores did not show a statistically significant reduction within or between the study groups. This finding may be attributed to the relatively short duration of the study. Gingival inflammation represents a host-mediated response to microbial challenge, and resolution of inflammatory changes often requires prolonged and consistent plaque control [16]. While plaque reduction can occur rapidly following improved oral hygiene practices, gingival tissues may take several weeks to months to exhibit measurable clinical healing. Therefore, the one-month follow-up period in the present study may

have been insufficient to capture significant changes in gingival inflammation.

Another factor contributing to the lack of significant gingival index improvement may be the inherent limitations of the gingival index itself. Gingival indices primarily assess visible signs of inflammation such as redness, edema, and bleeding on gentle probing, which may not be sensitive enough to detect subtle early changes [18]. Bleeding-based indices, such as bleeding on probing or the sulcus bleeding index, have been suggested to be more sensitive indicators of early inflammatory resolution and may have yielded different results if included in the assessment protocol.

Patient compliance and individual variations in oral hygiene behavior also play a critical role in determining clinical outcomes. Although participants in the test group were provided with logbooks to record the use of plaque-disclosing tablets, reliance on self-reported adherence may introduce reporting bias [17]. Patients may unintentionally overestimate their compliance or brushing effectiveness, leading to discrepancies between reported and actual behavior. Additionally, factors such as manual dexterity, prior oral hygiene habits, educational background, and personal motivation can influence the degree of improvement achieved.

Future studies should consider incorporating objective compliance assessment methods, such as electronic brushing monitors or supervised plaque disclosure sessions, to obtain more accurate data. Extending the follow-up period would also allow for a better evaluation of the long-term effects of plaque-disclosing tablets on gingival health and disease progression. Furthermore, combining plaque-disclosing agents with periodic professional reinforcement and individualized oral hygiene instruction may enhance both plaque control and gingival health outcomes.

Overall, the findings of the present study underscore the value of plaque-disclosing tablets as a practical, patient-centered adjunct in the management of gingivitis. While their short-term impact appears more pronounced on plaque control than on gingival inflammation, their role in promoting awareness, motivation, and sustained oral hygiene practices remains clinically significant.

Clinical Implications

Plaque-disclosing tablets are cost-effective, easy to use, and suitable for incorporation into routine dental



practice. Their use can enhance patient motivation, particularly in individuals with poor plaque control or low awareness. Regular reinforcement by dental professionals may further improve long-term outcomes.

Conclusion

Within the limitations of this one-month interventional study, the use of plaque-disclosing tablets as an adjunct to conventional oral hygiene instruction resulted in a statistically significant improvement in plaque control among patients with gingivitis. Although gingival index scores did not demonstrate significant changes, the observed reduction in plaque levels suggests that plaque-disclosing tablets serve as an effective motivational and self-assessment tool.

The findings emphasize the importance of visual feedback and patient engagement in achieving optimal oral hygiene. Longer-term studies with extended follow-up periods and additional clinical parameters are recommended to further evaluate the impact of plaque-disclosing tablets on gingival and periodontal health. Incorporating such adjunctive tools into routine preventive strategies may contribute to improved patient compliance and better periodontal outcome.

Ethical considerations: The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Ethical approval (Pr.664/IEC/SIBAR/2025). was obtained from the Institutional Ethics Committee of Sibar Institute of Dental Sciences, Guntur, prior to the commencement of the study.

Conflict of Interest

Nil.

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