Evaluating the role of Various Mouthwashes in dental plaque control among Orthodontic Patients

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Abstract

Background

Dental plaque control is crucial for maintaining oral health, especially in orthodontic patients who are at an increased risk of plaque accumulation due to the presence of brackets and wires. Mouthwashes serve as adjuncts to mechanical cleaning methods in reducing plaque levels and improving oral hygiene. This study aims to evaluate the effectiveness of various mouthwashes in dental plaque control among orthodontic patients.

Materials and Methods

A randomized clinical trial was conducted with 90 orthodontic patients aged 15–30 years, divided into three groups (n=30 each). Group A used a chlorhexidine mouthwash, Group B used a herbal mouthwash, and Group C used only mechanical plaque control (toothbrushing and interdental cleaning). Plaque Index (PI) was recorded at baseline, 1 week, and 4 weeks using the Turesky Modification of the Quigley-Hein Plaque Index. Statistical analysis was performed using ANOVA and post hoc tests, with a significance level set at $p<0.05$.

Results

At baseline, the mean PI values were comparable among the groups (Group A: 2.45 ± 0.12, Group B: 2.48 ± 0.10, Group C: 2.46 ± 0.14, $p>0.05$). At 4 weeks, Group A showed the highest reduction in plaque scores (1.05 ± 0.08), followed by Group B (1.30 ± 0.10), while Group C had the least reduction (1.95 ± 0.12). The difference between the groups was statistically significant ($p<0.001$).

Conclusion

The use of chlorhexidine mouthwash significantly improved dental plaque control in orthodontic patients compared to herbal mouthwash and mechanical methods alone. Herbal mouthwash also demonstrated efficacy, but to a lesser extent. Incorporating mouthwashes as adjuncts to mechanical plaque control can enhance oral hygiene outcomes during orthodontic treatment.

Keywords

Orthodontic patients, dental plaque, mouthwash, chlorhexidine, herbal mouthwash, oral hygiene, plaque control

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Introduction

Orthodontic treatment is widely recognized for its ability to correct dental malocclusions and improve oral health aesthetics. However, the presence of orthodontic appliances, such as brackets, wires, and bands, can create niches for plaque accumulation, thereby increasing the risk of dental caries, gingivitis, and periodontal issues (1). Effective dental plaque control is essential for preventing these complications and ensuring successful orthodontic treatment outcomes.

Mechanical cleaning methods, such as toothbrushing and flossing, remain the cornerstone of plaque control. However, orthodontic appliances often make these methods challenging for patients, necessitating the use of adjunctive chemical plaque control measures, such as mouthwashes (2). Chlorhexidine, a gold standard antimicrobial agent, has demonstrated significant efficacy in reducing plaque levels and gingival inflammation (3). Despite its effectiveness, concerns about side effects, including tooth staining and altered taste perception, have spurred interest in herbal alternatives (4). Herbal mouthwashes, derived from natural plant extracts with antimicrobial properties, are gaining popularity as they offer a safer profile and similar efficacy in plaque control (5).

While the efficacy of individual mouthwashes has been studied, comparative analyses among different types of mouthwashes in orthodontic patients remain limited. This study aims to evaluate and compare the efficacy of chlorhexidine and herbal mouthwashes in controlling dental plaque among orthodontic patients. By providing insights into the most effective adjunctive oral hygiene measures, this research seeks to enhance clinical recommendations and improve patient compliance during orthodontic treatment.

Materials and Methods

Study Design

This was a randomized, controlled clinical trial conducted over four weeks to evaluate the efficacy of different mouthwashes in controlling dental plaque among orthodontic patients.

Participants

Ninety orthodontic patients aged 15–30 years, undergoing fixed orthodontic treatment, were recruited for the study. Inclusion criteria included patients with good systemic health, absence of active periodontal disease, and a willingness to comply with study instructions. Patients using systemic antibiotics or other mouthwashes within the past month, or those with a history of hypersensitivity to mouthwash components, were excluded.

Group Allocation

Participants were randomly assigned into three groups using a computer-generated randomization sequence, with 30 participants in each group:

- **Group A:** Chlorhexidine mouthwash (0.12%)

- **Group B:** Herbal mouthwash (commercially available with known antimicrobial properties)

- **Group C:** Control group (no mouthwash; mechanical plaque control only)

Procedure

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Baseline plaque levels were recorded for all participants using the Turesky Modification of the Quigley-Hein Plaque Index (PI). Participants were instructed to continue their regular brushing routine and use the assigned mouthwash twice daily, 30 minutes after brushing. Each participant in Groups A and B was provided with 15 mL of mouthwash to rinse for 30 seconds, as per the manufacturer's instructions.

Follow-up PI scores were recorded at one week and four weeks by a single calibrated examiner who was blinded to group allocation. Standardized oral hygiene instructions were reinforced at each visit to ensure compliance.

Statistical Analysis

Data were analyzed using SPSS software (version 25.0). Descriptive statistics, including means and standard deviations, were calculated for PI scores at baseline, 1 week, and 4 weeks. Differences between groups were evaluated using analysis of variance (ANOVA), followed by post hoc Tukey's tests for pairwise comparisons. A p-value <0.05 was considered statistically significant.

Results

A total of 90 participants completed the study, with 30 in each group. The mean Plaque Index (PI) scores for each group at baseline, 1 week, and 4 weeks are presented in **Table 1**. At baseline, no significant differences were observed among the groups ($p>0.05$), indicating homogeneity of the sample.

After 1 week, a significant reduction in PI scores was observed in all groups, with Group A (chlorhexidine mouthwash) showing the most significant reduction, followed by Group B (herbal mouthwash) and Group C (control group). By 4 weeks, Group A demonstrated the lowest PI scores, indicating superior efficacy in plaque control compared to the other groups (**Table 1**).

Post hoc analysis revealed that the reduction in PI scores for Group A was significantly greater than that for Groups B and C ($p<0.001$). Group B also showed a significant reduction compared to Group C ($p<0.01$).

Table 1: Mean Plaque Index (PI) Scores Across Groups

Time Point	Group A (Chlorhexidine)	Group B (Herbal)	Group C (Control)	p-value
Baseline	2.45 ± 0.12	2.48 ± 0.10	2.46 ± 0.14	>0.05
After 1 Week	1.35 ± 0.10	1.55 ± 0.12	2.10 ± 0.15	<0.001
After 4 Weeks	1.05 ± 0.08	1.30 ± 0.10	1.95 ± 0.12	<0.001

The percentage reduction in PI scores from baseline to 4 weeks was highest in Group A (57.1%), followed by Group B (47.6%) and Group C (20.7%). These findings support the superior efficacy of chlorhexidine mouthwash in controlling dental plaque among orthodontic patients.

Discussion

Effective plaque control is essential for maintaining oral health during orthodontic treatment, as fixed appliances create niches for plaque accumulation, increasing the risk of caries and

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periodontal diseases (1). This study evaluated the efficacy of chlorhexidine and herbal mouthwashes in reducing dental plaque among orthodontic patients and found that chlorhexidine mouthwash was significantly more effective than herbal mouthwash and mechanical methods alone.

The results demonstrated a significant reduction in Plaque Index (PI) scores in all groups over the study period, with the greatest reduction observed in the chlorhexidine group. Chlorhexidine has long been considered the gold standard for chemical plaque control due to its broad-spectrum antimicrobial activity and substantivity, which allow it to remain effective for an extended period after application (2,3). Similar findings have been reported in previous studies, which highlighted the superior efficacy of chlorhexidine in reducing plaque and gingival inflammation (4,5).

Herbal mouthwash also showed significant plaque reduction, albeit less effective than chlorhexidine. Herbal formulations often contain natural antimicrobial agents, such as essential oils, aloe vera, and neem, which exhibit inhibitory effects on plaque-forming bacteria (6,7). The growing interest in herbal alternatives is driven by their safer profile and fewer side effects, such as staining and altered taste, commonly associated with chlorhexidine (8,9). Previous studies have shown comparable efficacy of herbal mouthwashes to chlorhexidine in reducing plaque and gingivitis in short-term trials (10,11).

The control group, which relied solely on mechanical plaque control, showed the least reduction in PI scores. This finding underscores the challenges faced by orthodontic patients in maintaining effective oral hygiene due to the complex structure of fixed appliances, which hinders access to all tooth surfaces (12,13). Previous research has emphasized the importance of adjunctive chemical plaque control in such cases to enhance oral hygiene outcomes (14,15).

Despite the efficacy of chlorhexidine, its prolonged use is associated with side effects, which may affect patient compliance. The use of herbal mouthwash, while slightly less effective, offers a viable alternative for patients seeking a more natural approach to oral hygiene. Future studies with larger sample sizes and longer durations are recommended to assess the long-term efficacy and safety of these interventions.

This study was limited by its short duration and the lack of microbiological analysis to confirm reductions in specific bacterial species. Future research should explore these aspects to provide a more comprehensive understanding of the mechanisms behind the efficacy of different mouthwashes.

Conclusion

Chlorhexidine mouthwash demonstrated superior efficacy in controlling dental plaque among orthodontic patients compared to herbal mouthwash and mechanical methods alone. However, herbal mouthwashes may serve as a suitable alternative for patients seeking natural products with fewer side effects.

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