

Comparative Periodontal Health in Patients Undergoing Orthodontic Treatment with Clear Aligners Versus Fixed Appliances: A Questionnaire-Based Study

Abstract:

Background: Orthodontic appliances influence plaque accumulation and periodontal health. Fixed orthodontic appliances often hinder effective oral hygiene, whereas clear aligners are removable and may facilitate better plaque control.

Aim: To compare periodontal health outcomes in patients undergoing orthodontic treatment with fixed appliances and clear aligners.

Materials and Methods: A cross-sectional questionnaire-based study (16 questions) was conducted over 6–9 months among 364 orthodontic patients. Participants were categorized into two groups: fixed appliance therapy (n=227) and clear aligner therapy (n=137). Parameters assessed included gingival bleeding, gingival swelling, halitosis, gingival recession, oral hygiene compliance, and patient-perceived gum health outcomes. Data were analyzed using descriptive statistics and Chi-square test using SPSS version 25.0. A p-value <0.05 was considered statistically significant.

Results: Among the participants, 227 (62.4%) were treated with fixed appliances and 137 (37.6%) with clear aligners. Patients treated with fixed appliances reported significantly higher gingival bleeding, swelling, halitosis, and gingival recession. Oral hygiene compliance and perceived improvement in gum health were higher among aligner patients.

Conclusion: Clear aligner therapy demonstrated comparatively better periodontal health outcomes than fixed orthodontic appliances, possibly due to improved accessibility for oral hygiene maintenance.

Key-words: Clear aligners, Fixed orthodontic appliances, Periodontal health, Orthodontic treatment, Oral hygiene.

Introduction:

Periodontal health represents the absence of clinical inflammation and maintenance of homeostasis of the supporting structures of teeth. Maintaining periodontal health during orthodontic treatment is essential because orthodontic appliances may influence plaque accumulation and gingival inflammation.[1] Orthodontic treatment aims to correct dental malocclusion and improve both aesthetics and oral function. Conventional orthodontic therapy uses fixed appliances such as brackets, bands, arch wires, and ligatures attached to the tooth surface.[2] These components often create plaque-retentive areas that make oral hygiene procedures difficult and increase the risk of gingival inflammation, gingival bleeding, and periodontal complications. Clear aligner therapy (CA) has

emerged as an alternative to traditional fixed orthodontic appliances (FA). These removable appliances offer advantages such as improved aesthetics, greater patient comfort, and easier maintenance of oral hygiene.[3] Because aligners can be removed during meals and brushing, patients may maintain better plaque control and gingival health

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compared with fixed appliance therapy. Several studies have evaluated periodontal health during orthodontic treatment. Earlier investigations reported increased plaque accumulation and gingival inflammation around fixed orthodontic appliances due to mechanical retention sites for biofilm. In contrast, studies evaluating aligner therapy have suggested improved periodontal parameters such as lower plaque index, gingival index, and bleeding scores. [4-6] Numerous systematic reviews and meta-analyses indicate a better level of hygiene and periodontal condition in patients treated with CA. [7] Recent systematic reviews and meta-analyses (2018–2025) suggest that clear aligners are associated with improved periodontal outcomes, including reduced plaque accumulation and gingival inflammation, primarily due to enhanced oral hygiene accessibility. However, evidence remains heterogeneous, with some studies reporting comparable outcomes between aligners and fixed appliances, emphasizing the need for further high-quality randomized controlled trials. [7-12]

However, previous studies have reported conflicting evidence regarding periodontal outcomes between aligner therapy and fixed appliance therapy. Therefore, the aim of the present study was to compare periodontal health outcomes in orthodontic patients treated with clear aligners and fixed appliances using a questionnaire-based cross-sectional design.

Materials and Methods:

A cross-sectional questionnaire-based study was conducted using an online survey over a period of 6–9 months. A total of 364 orthodontic patients undergoing or having completed orthodontic treatment participated in the study. Participants were categorized into two groups: those treated with fixed orthodontic appliances ($n = 227$) and those treated with clear aligners ($n = 137$). Participants were recruited using convenience sampling through online distribution of the questionnaire. Patients undergoing or who had completed orthodontic treatment with either fixed appliances or clear aligners were included in the study, whereas those with incomplete questionnaire responses or systemic diseases affecting periodontal health were excluded.

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Results:

A total of 364 orthodontic patients participated in the study. Among them, 227 patients (62.4%) were treated with fixed appliances and 137 patients (37.6%) were treated with clear aligners.

Gingival bleeding was significantly higher in the fixed appliance group compared with the aligner group ($p < 0.001$). Similarly, gingival swelling and halitosis were significantly more prevalent among patients with fixed appliances ($p < 0.001$). Gingival recession was also significantly higher in the fixed appliance group ($p = 0.03$).

Oral hygiene compliance was significantly better among patients treated with clear aligners ($p < 0.001$). In addition, patient-perceived improvement in overall gum health was significantly higher in the aligner group ($p = 0.015$).

Table 1. Distribution of Study Participants

Treatment Type	Number (n)	Percentage (%)
Fixed appliances	227	62.4
Clear aligners	137	37.6
Total	364	100

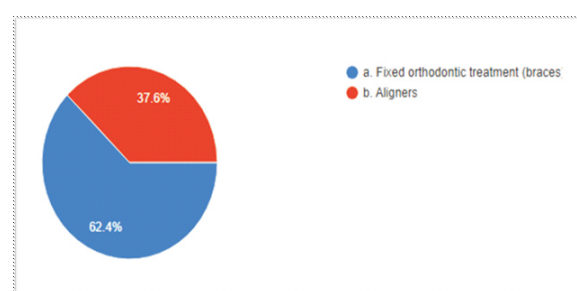


Figure 1. Distribution of study participants

Table 2. Gingival Bleeding

Bleeding Frequency	Fixed n (%)	Aligners n (%)	p-value
Never	98 (43.2)	89 (64.9)	<0.001
Rare/Very rare	95 (41.8)	42 (30.7)	
Frequently	34 (15.0)	6 (4.4)	

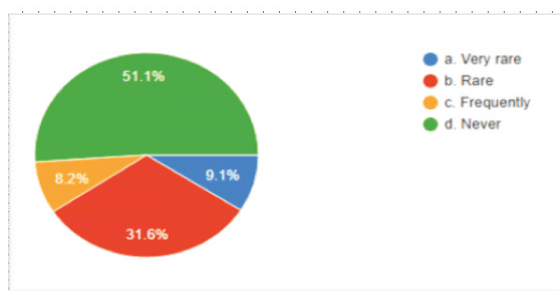


Figure 2. Gingival bleeding frequency. Note- Chart showing combined data of both groups

Table 3. Gingival Swelling

Swelling Frequency	Fixed n (%)	Aligners n (%)	p-value
Never	103 (45.3)	94 (68.6)	
Rare/Very rare	94 (41.4)	37 (27.0)	
Frequently	30 (13.3)	6 (4.4)	<0.001

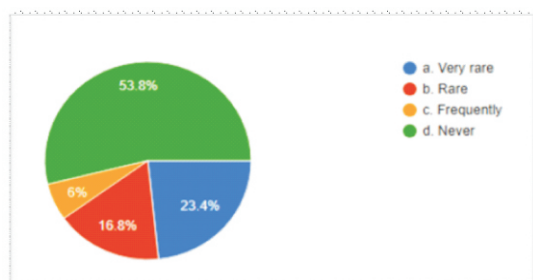


Figure 3. Gingival Swelling frequency. Note- Chart showing combined data of both groups

Table 4. Halitosis

Bad Breath	Fixed n (%)	Aligners n (%)	p-value
Frequently	123 (54.2)	43 (31.4)	<0.001
Rare/Very rare/never	104 (45.8)	94 (68.6)	

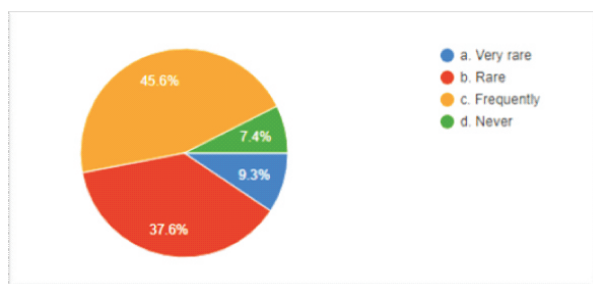


Figure 4. Halitosis frequency. Note- Chart showing combined data of both groups

Table 5. Gingival Recession

Recession	Fixed n (%)	Aligners n (%)	p-value
Yes	33 (14.5)	9 (6.6)	0.03
No	194 (85.5)	128 (93.4)	

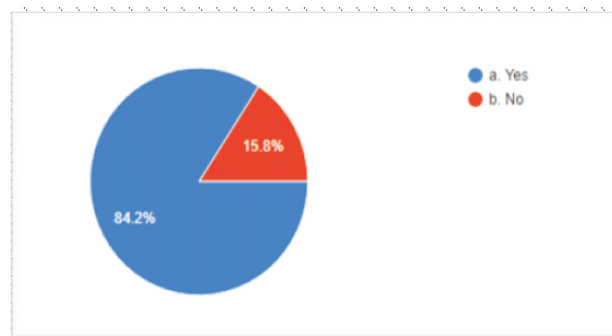


Figure 5. Gingival recession frequency. Note- Chart showing combined data of both

Table 6. Oral Hygiene Compliance

Compliance	Fixed n (%)	Aligners n (%)	p-value
Good	132 (58.1)	105 (76.6)	<0.001
Poor	95 (41.9)	32 (23.4)	

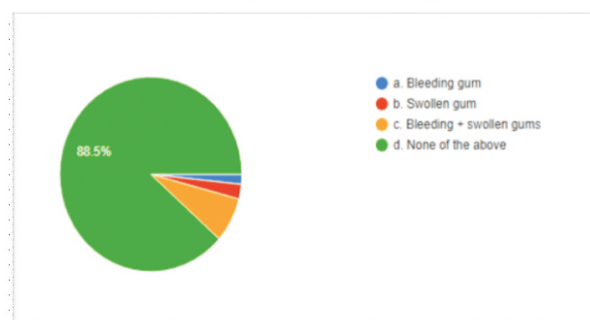


Figure 6. Oral Hygiene compliance. Note- Chart showing combined data of

Table 7. Overall, Gum Health Outcome

Outcome	Fixed n (%)	Aligners n (%)	p-value
Improved	134 (59.0)	99 (72.3)	0.015
Not improved	93 (41.0)	38 (27.7)	

Discussion:

The findings of the present study suggest that patients undergoing orthodontic treatment with clear aligners demonstrate better periodontal health outcomes compared to those treated with fixed appliances. This may be attributed to the removable nature of aligners, which allows patients to maintain better oral hygiene practices.

Fixed orthodontic appliances create plaque-retentive areas around brackets, wires, and ligatures, which may facilitate bacterial accumulation and gingival inflammation. As plaque control becomes more challenging in such conditions, patients undergoing fixed appliance therapy may experience increased gingival bleeding, swelling, and halitosis.[2]

Previous studies have reported similar findings. Miethke and Vogt reported improved periodontal status in patients treated with Invisalign aligners compared to fixed orthodontic appliances.[1] Karkhaneechi et al. also demonstrated better periodontal parameters among aligner patients due to easier plaque removal and improved oral hygiene access.[5] Jiang et al., in a meta-analysis, reported that aligner therapy was associated with lower plaque index and gingival index compared to fixed appliances [2]. The results of the present study further support these findings, demonstrating statistically significant differences in several periodontal parameters including gingival bleeding, swelling, halitosis, and oral hygiene compliance. These findings emphasize the importance of appliance design and patient hygiene accessibility during orthodontic therapy. Despite these advantages, successful aligner therapy depends on patient compliance. Aligners must be worn for the recommended duration each day to ensure effective tooth movement. Therefore, clinicians must emphasize patient education and regular monitoring during orthodontic treatment. [8]

Conclusion:

Within the limitations of this questionnaire-based cross-sectional study, clear aligner therapy demonstrated better periodontal health outcomes compared to fixed orthodontic appliances. The removable nature of aligners likely facilitates improved oral hygiene and reduced plaque accumulation, resulting in better gingival health during orthodontic treatment. Patients treated with aligners reported lower gingival inflammation and better oral hygiene compliance.

Limitations:

The study relied on self-reported questionnaire responses which may introduce reporting bias. Clinical periodontal parameters such as plaque index, gingival index, probing depth, and clinical attachment level were not recorded. Longitudinal clinical studies are recommended to validate these findings.

Supplementary Questionnaire

The questionnaire used in this study is provided as supplementary material

1. Type of orthodontic treatment received.
2. Frequency of gingival bleeding during brushing.
3. Presence of gingival swelling during treatment.
4. Experience of bad breath during orthodontic therapy.
5. Presence of gingival recession.
6. Oral hygiene practices during treatment.
7. Perceived improvement in gum health after treatment.

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Author Contributions

Conceptualization, methodology, data collection, analysis, and manuscript preparation were performed by the authors.

Data Availability Statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Conflict of Interest

The authors declare no conflict of interest.

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