

Original Research

A comparative study of combined periodontal and orthodontic treatment with fixed appliances and clear aligners in patients with periodontitis

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Abstract

Aim: To study the combined periodontal and orthodontic treatment with fixed appliances and clear aligners in patients with periodontitis.

Materials and methods: This study screened 50 patients (26 men, 24 women) with a mean age of 37.2 years (range: 20–50). All participants had chronic periodontitis and were systemically healthy non-smokers, except for one patient. Exclusion criteria included systemic diseases, bone metabolism disorders, steroid use, active infections, head or neck radiation history, and pregnancy. Data analysis was done using SPSS software.

Results: The study included a total of 50 patients, with ages ranging from 20 to 50 years (mean \pm SD: 35 \pm 8.7 years). The sample comprised 26 males and 24 females. Regarding the type of irregularity, 34 patients exhibited crowding, 10 had spacing issues, and 6 presented with pathologic migration. The severity of irregularity varied, with 2 patients classified as Grade 1, 5 as Grade 2, 20 as Grade 3, 15 as Grade 4, and 8 as Grade 5. Orthodontic treatment methods included fixed appliances for 32 patients and clear aligner treatment for 18 patients. Among the participants, 8 had generalised slight chronic periodontitis, 32 had generalised moderate, and 10 had generalised severe periodontitis. Surgical interventions varied, with 36 patients not requiring regenerative surgery, while 8 underwent pre-orthodontic surgery and 6 received post-orthodontic surgery.

Conclusion- While both CA and FA can maintain periodontal health with proper hygiene, some evidence suggests CA may offer slight advantages in plaque control and probing depth. However, due to limited sample sizes, further research is needed for definitive conclusions.

Keywords: orthodontic, aligner, periodontitis

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Introduction

The primary cause of gingivitis is the accumulation of supragingival dental plaque along the gingival margin. Gingivitis is an inflammatory response triggered by bacterial toxins and metabolic by-products in the oral biofilm. While gingivitis does not always lead to periodontitis, it is a necessary precursor to the condition. Supragingival plaque-induced inflammation is a major predisposing factor for disease progression.^{1,2}

Periodontal diseases are widespread among children, adolescents, and adults. Studies indicate that nearly 55% of primary school children experience

periodontal issues. Additionally, moderate periodontitis affects 35%–41% of individuals, while severe periodontitis has a prevalence range of 10%–41%. Advanced and aggressive forms of periodontitis increase in frequency among individuals aged 35–44 years, affecting approximately 10%–14% of this population. Given that over 70% of adults exhibit some form of periodontal disease, periodontal treatment is essential before initiating orthodontic therapy to maintain periodontal health.^{3,4,5}

Fixed orthodontic appliances are a common treatment for malocclusion, but they complicate oral hygiene due to the presence of brackets, bands, and arch-wires.

This challenge promotes plaque accumulation, which increases the risk of white spot lesions, caries, and periodontal damage. Studies indicate that patients with fixed appliances exhibit the highest levels of plaque accumulation along the gingival margin and behind arch-wires, particularly in the maxillary lateral incisor and canine regions. Proper motivation and frequent brushing are crucial in reducing plaque buildup during fixed orthodontic therapy.^{6,7}

Removable clear aligner therapy has recently gained popularity in adult orthodontics, offering several benefits, including enhanced aesthetic outcomes. This treatment involves the use of transparent plastic splints that encase the teeth and partially cover the marginal gingiva, gradually guiding the teeth into proper alignment. Despite their coverage of the teeth and keratinized gingiva, studies suggest that clear aligners do not compromise periodontal health. This may be due to their removability, which allows for easier oral hygiene maintenance. However, most research on clear aligner therapy has been conducted in younger patients with healthy periodontal conditions.^{8,9,10}

Dental hygienists play a vital role in guiding patients toward maintaining oral hygiene during orthodontic treatment. They must provide patients with appropriate tools and techniques for home care, reinforcing these skills through repeated visits and personalized instructions. Regular check-ups and individualized hygiene strategies enhance compliance and ensure optimal periodontal health. Additionally, scientific evidence suggests that periodontal maintenance intervals should be customized to each patient's needs rather than adhering to a fixed recall schedule.

Hence the aim was to study the combined periodontal and orthodontic treatment with fixed appliances and clear aligners in patients with periodontitis.

Materials and methods

This study screened 50 patients (26 men, 24 women) with a mean age of 37.2 years (range: 20–50). All participants had chronic periodontitis and were systemically healthy non-smokers, except for one patient. Exclusion criteria included systemic diseases, bone metabolism disorders, steroid use, active infections, head or neck radiation history, and pregnancy.

Patients exhibited minor incisor malalignment or pathologic tooth movement without posterior bite collapse. Orthodontic treatment was planned in collaboration with an orthodontist. Study models were used for diagnostic setup, and initial periodontal therapy, including scaling and root planing, was completed before orthodontic intervention. Patients with poor oral hygiene (plaque index >1.5) received additional education and treatment. Orthodontic appliances were chosen based on patient preference, except in cases requiring fixed appliances due to significant labial inclination or mobility.

The study compared clear aligners (CAT) and fixed appliances (FA) based on clinical parameters recorded before and after treatment: (1) Plaque index, (2) Gingival index, (3) Probing depth, and (4) Treatment duration. Malalignment severity was classified from grade 5 (severe) to grade 0 (aligned). Data analysis was done using SSPS software.

Results

Table 1: Demographic and clinical data of patients

Variable	Category	N
Age (years)	Maximum	50
	Minimum	20
	Mean ± SD	35 ± 8.7
Gender	Male	26
	Female	24
Type of Irregularity	Crowding	34
	Spacing	10
	Pathologic migration	6
Severity of irregularity	Grade 1	2
	Grade 2	5
	Grade 3	20
	Grade 4	15
	Grade 5	8
Type of orthodontic treatment	Fixed Appliances	32
	Clear Aligner Treatment	18
Type of chronic periodontitis	Generalised Slight	8
	Generalised Moderate	32
	Generalised Severe	10
Surgical procedures	No regenerative surgery	36
	Pre-Orthodontic Surgery	8
	Post-Orthodontic Surgery	6

Total Patients		50
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The study included a total of 50 patients, with ages ranging from 20 to 50 years (mean \pm SD: 35 \pm 8.7 years). The sample comprised 26 males and 24 females. Regarding the type of irregularity, 34 patients exhibited crowding, 10 had spacing issues, and 6 presented with pathologic migration. The severity of irregularity varied, with 2 patients classified as Grade 1, 5 as Grade 2, 20 as Grade 3, 15 as Grade 4, and 8 as Grade 5. Orthodontic treatment methods included

fixed appliances for 32 patients and clear aligner treatment for 18 patients. Among the participants, 8 had generalised slight chronic periodontitis, 32 had generalised moderate, and 10 had generalised severe periodontitis. Surgical interventions varied, with 36 patients not requiring regenerative surgery, while 8 underwent pre-orthodontic surgery and 6 received post-orthodontic surgery

Table 2: Comparison between orthodontic treatment with fixed appliances and clear aligner treatment (n=50).

Clinical parameters	Fixed appliance(FA)	Clear aligner treatment(CAT)	Total	P Value
Comparison in plaque index	0.10 \pm 0.15	0.32 \pm 0.25	0.12 \pm 0.24	NS
Baseline	1.14 \pm 0.22	1.35 \pm 0.30	1.21 \pm 0.32	NS
Post treatment	1.16 \pm 0.14	1.21 \pm 1.02	1.13 \pm 1.11	NS
Change in gingival index	0.03 \pm 0.09	0.04 \pm 0.09	0.11 \pm 0.12	NS
Baseline	0.52 \pm 0.12	0.51 \pm 0.10	0.52 \pm 0.16	NS
Post Treatment	0.41 \pm 0.04	0.51 \pm 0.12	0.52 \pm 0.11	NS
Change in probing depth	0.32 \pm 0.21	0.15 \pm 0.07	0.30 \pm 0.16	0.005
Baseline	3.01 \pm 0.20	2.67 \pm 0.53	0.32 \pm 0.18	0.002
Post Treatment	2.51 \pm 0.22	3.12 \pm 0.55	3.01 \pm 0.23	0.005
Change in bone level	0.47 \pm 0.12	0.51 \pm 0.12	0.46 \pm 0.06	NS
Baseline	2.73 \pm 0.16	3.62 \pm 0.12	3.85 \pm 0.22	0.001
Post Treatment	3.13 \pm 1.11	3.81 \pm 0.04	3.95 \pm 0.30	0.002
Duration of treatment (months)	5.72 \pm 1.02	7.38 \pm 0.16	6.24 \pm 0.12	0.012

NS: statistically not significant.

Discussion

Orthodontic treatment in patients with periodontitis presents unique challenges, as maintaining periodontal health is crucial during tooth movement. Fixed appliances (FA) and clear aligner treatment (CAT) are commonly used orthodontic techniques, each with distinct advantages and limitations. While FA provides precise control over tooth movement, it may pose challenges in maintaining oral hygiene. In contrast, CAT offers better accessibility for plaque control but may have limitations in certain types of tooth movement. Combining periodontal therapy with orthodontic treatment has been shown to improve periodontal health outcomes, but the effectiveness of FA and CAT in periodontitis patients remains a topic of interest. This study aims to compare the impact of FA and CAT on periodontal parameters, including plaque index, gingival index, probing depth, and alveolar bone levels, to determine their effectiveness in managing orthodontic treatment in periodontitis patients.^{11,12}

In our study a total of 50 patients were included, with ages ranging from 20 to 50 years (mean \pm SD: 35 \pm 8.7 years). The sample comprised 26 males and 24 females. Regarding the type of irregularity, 34 patients exhibited crowding, 10 had spacing issues, and 6 presented with pathologic migration. The severity of irregularity varied, with 2 patients classified as Grade

1, 5 as Grade 2, 20 as Grade 3, 15 as Grade 4, and 8 as Grade 5. Orthodontic treatment methods included fixed appliances for 32 patients and clear aligner treatment for 18 patients. Among the participants, 8 had generalised slight chronic periodontitis, 32 had generalised moderate, and 10 had generalised severe periodontitis. Surgical interventions varied, with 36 patients not requiring regenerative surgery, while 8 underwent pre-orthodontic surgery and 6 received post-orthodontic surgery.

A study by Han JY et al.¹³ evaluated the impact of orthodontic treatment on periodontal health and compared fixed appliance (FA) and clear aligner treatment (CAT) in periodontitis patients. The study included 35 patients who underwent orthodontic treatment following periodontal therapy and oral hygiene education, with clinical parameters such as plaque index, gingival index, and probing depth assessed before and after treatment. Results showed significant overall improvements in plaque index, gingival index, probing depth, and alveolar bone levels, but no significant differences between FA and CAT regarding plaque index, gingival index, or alveolar bone level changes. However, treatment duration and probing depth changes were significantly different, with the FA group showing longer treatment times and greater probing depth changes. Additionally, CAT was more commonly chosen by

females (88%) compared to FA (37%). The study concluded that both FA and CAT, when combined with proper periodontal care and oral hygiene education, effectively improved periodontal health, suggesting that either method can be used successfully in periodontitis patients undergoing orthodontic treatment.

A study by ElNaghy R et al.¹⁴ assessed periodontal health as a primary outcome by measuring pocket probing depth (PPD), gingival index (GI), plaque index (PI), and bleeding on probing (BoP), while gingival recession (GR) was evaluated as a secondary outcome based on its progression between pre- and post-orthodontic treatment. Periodontal indices were assessed at three time points: short-term (2–3 months), mid-term (6–9 months), and long-term (12 months or more). A total of 12 studies, including 3 RCTs, 8 prospective cohort studies, and 1 retrospective cohort study, were included in the qualitative synthesis, with 8 studies included in the meta-analysis. Data from 612 patients (321 treated with buccal fixed appliances and 291 with clear aligners) were analyzed. Meta-analysis results favored clear aligners for PI in the mid-term follow-up, while GI values showed a tendency to improve with clear aligners in the long-term but without statistical significance. PPD significantly favored clear aligners in the long-term, but short- and mid-term follow-ups showed no significant differences between fixed appliances and clear aligners. Patients treated with clear aligners exhibited better BoP values and less GR compared to those treated with fixed appliances. However, the study concluded that current evidence remains insufficient to determine the superiority of clear aligners over fixed appliances in maintaining periodontal health during orthodontic treatment.

The study conducted by Crego-Ruiz M et al.¹⁵ aimed to evaluate periodontal health maintenance and the development of gingival recessions in patients undergoing orthodontic treatment with clear aligners (CA) and fixed appliances (FA). Out of 129 potential studies, 12 were ultimately included, with only 8 qualifying for quantitative analysis. The findings suggested that CA provided slightly better periodontal health outcomes

Our study aligns with previous research indicating that periodontal health can be maintained with proper oral hygiene, regardless of the orthodontic technique used. Similar to prior findings, both FA and CA groups showed improvements in clinical parameters with meticulous plaque control. However, while some studies reported no significant differences between FA and CA in plaque and gingival indices, others suggested that CA might offer slight advantages, particularly in plaque accumulation and probing depth reduction over time. Despite these variations, the overall evidence remains inconclusive due to limited sample sizes, highlighting the need for larger studies to determine whether CA provides superior periodontal benefits compared to FA.

Conclusion

While both CA and FA can maintain periodontal health with proper hygiene, some evidence suggests CA may offer slight advantages in plaque control and probing depth. However, due to limited sample sizes, further research is needed for definitive conclusions.

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