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

Background: This was a comparative study of combined periodontal and orthodontic treatment with fixed appliances and clear aligners in patients with periodontitis.

Material and methods:A cohort of 50 patients, comprising 20 males and 30 females, who received orthodontic treatment, was evaluated for participation in this study. The criteria for inclusion specified that patients must have chronic periodontitis characterized by more than 2 mm of attachment loss and probing pocket depths exceeding 3 mm. All participants were in satisfactory general health, exhibiting no indications of systemic illness. Notably, all but one patient were non-smokers. Additional exclusion criteria included the presence of active infections, conditions that could impair bone metabolism or wound healing, a history of radiation therapy to the head or neck, regular use of steroids or other medications that influence bone turnover, and pregnancy. Each patient exhibited minor malalignment of incisors or pathological movement of the maxillary or mandibular incisors, without signs of posterior bite collapse. From the outset of treatment planning, all cases were reviewed with an orthodontist from the Department of Orthodontics, ensuring that the primary needs of the patients were thoroughly considered. For diagnostic purposes, study casts were replicated, and the misaligned or pathologically displaced teeth were meticulously excised from the model. These teeth were subsequently repositioned in an ideal alignment using wax. Following scaling and root planning, along with ongoing education on mechanical supragingival plaque control, each patient underwent a re-evaluation. In instances where oral hygiene was deemed inadequate (plaque index >1.5), further education on oral hygiene practices and periodontal treatment was provided prior to the initiation of orthodontic therapy. Upon completion of the initial periodontal intervention, minor movements of the anterior teeth were performed. Except for those patients who required fixed appliances due to significant labial inclinations or mobility of anterior teeth, the selection of orthodontic appliances was based on patient preference, following comprehensive discussions regarding the benefits and drawbacks of the two methods. Statistical analyses were performed utilizing SPSS software.

Results: In this study, there were 50 subjects of which 25 received fixed appliance treatment and 25 received clear aligner treatment. There were 50 subjects of which 20 were male and 30 were female. Mandible was involved in total 35 cases. 19 fixed appliance cases were evident in mandible and 6 fixed appliance cases were of maxilla. Clear alignment treatment was done in 9 maxillary arch and 16 mandibular arches. The duration of treatment for fixed appliance was 4.27±1.83 months and the duration of treatment of clear aligners was 6.98±2.25 months. The baseline plaque index of the subjects of fixed appliance group was 1.51±0.76 and the post-treatment value of plaque index in the same group was 1.03±0.19. The baseline plaque index of the subjects of clear aligner group was 1.32±0.38 and the post-treatment value of plaque index in the same group was 1.04±0.24. The baseline plaque index of the subjects of clear aligner group was 0.61±0.12 and the post-treatment value of plaque index in the same group was 0.51±0.18. The baseline plaque index of the subjects of clear aligner group was 0.59±0.23 and the post-treatment value of plaque index in the same group was 0.42±0.11.

Conclusion: Following orthodontic treatment, there was a notable enhancement in clinical parameters within both the fixed appliance and clear alignment treatment groups, attributed to comprehensive oral hygiene education and effective plaque management. When examining the plaque index and gingival index, no significant disparities were observed between the two groups. It is proposed that an integrated approach to periodontal and orthodontic treatment can enhance the periodontal health of patients, regardless of the specific orthodontic methods employed.

Keywords:fixed appliance, clear aligner, orthodontic therapy, periodontal treatment, root planning.

Introduction

Orthodontic treatment ensures the accurate positioning of the teeth and optimizes the occlusion–jaw relationship. This approach not only improves the quality of life by helping patients with eating, talking, and their appearance but also improves their overall health. Therefore, the number of adult patients choosing orthodontic treatment has steadily risen in recent years.[1]

Effective collaboration, coordination, and communication between various dental specialists are crucial for ensuring more accurate diagnosis and optimized treatment planning. Interdisciplinary interaction is paramount and, in certain instances, facilitates coordinated dental therapy.[2]

The effect of orthodontic treatment on the prevalence of periodontitis has been debated among scholars. Recently, periodontal health's importance has increased in line with the number of adult orthodontic patients. The orthodontic treatment–periodontitis relationship has been widely studied by scholars, and it often has a synergistic character. Orthodontic treatments enhance periodontal health by aligning teeth and balancing occlusion, in turn improving hygiene by making it easier for patients to access their teeth and reducing occlusal trauma. Fixed orthodontic devices can enhance supragingival biofilm formation and worsen periodontal tissue's condition. Orthodontic pressures can lead to inflammation in the periodontium. This reaction is essential for the orthodontic tooth movement process. One challenge in orthodontics is performing treatment without impacting the root and periodontium.[3]

Periodontal health is defined by the absence of microscopically and macroscopically detectable signs of inflammation that may affect periodontal physiology.[4]

Periodontal health maintenance in patients undergoing orthodontic treatment depends on several factors, including the patient's oral hygiene habits and biofilm control, periodontal host–microbe homeostasis, periodontal phenotype, especially with regard to buccal bone plate width, systemic conditions and diseases (e.g., diabetes mellitus) directly and indirectly affecting the periodontal status and oral microbiome, and personal habits (e.g., smoking).[5,6]

Traditional orthodontic treatment encourages tooth movement to correct dental malocclusion through appliances fixed to teeth surfaces, such as orthodontic bands and brackets, archwires, ligatures, and auxiliaries.[7,8]

This was a comparative study of combined periodontal and orthodontic treatment with fixed appliances and clear aligners in patients with periodontitis.

Material and methods

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Results

Table 1: Group-wise distribution of subjects

Group	Number of subjects	Percentage
Group 1 (Fixed appliance)	25	50
Group 2 (Clear aligner)	25	50
Total	50	100

In this study, there were 50 subjects of which 25 received fixed appliance treatment and 25 received clear aligner treatment.

Table 1: Gender-wise distribution of subjects

Gender	Number of subjects	Percentage
Male	20	40
Female	30	60
Total	50	100

There were 50 subjects of which 20 were male and 30 were female.

Table 2: Comparison between orthodontic treatment with fixed appliances and clear aligner treatment.

Clinical parameters	Total	Fixed Appliance (n=25)	Clear Alignment Treatment (n=25)
Number of patients	50	25	25
Male/Female	20/30	13/12	07/18
Maxilla/mandibular	15/35	06/19	09/16
Duration of treatment (months)		4.27±1.83	6.98±2.25
Plaque index Baseline: Post-treatment:		 1.51±0.76 1.03±0.19	 1.32±0.38 1.04±0.24
Gingival index Baseline: Post-treatment:		 0.61±0.12 0.51±0.18	 0.59±0.23 0.42±0.11

In this study, there were 50 subjects of which 25 received fixed appliance treatment and 25 received clear aligner treatment. There were 50 subjects of which 20 were male and 30 were female. Mandible was involved in total 35 cases. 19 fixed appliance cases were evident in mandible and 6 fixed appliance cases were of maxilla. Clear alignment treatment was done in 9 maxillary arch and 16 mandibular arches. The duration of treatment for fixed appliance was 4.27±1.83 months and the duration of treatment of clear aligners was 6.98±2.25 months.

The baseline plaque index of the subjects of fixed appliance group was 1.51±0.76 and the post-treatment value of plaque index in the same group was 1.03±0.19. The baseline plaque index of the subjects of clear aligner group was 1.32±0.38 and the post-treatment value of plaque index in the same group was 1.04±0.24.

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Discussion

Over the past few decades, orthodontic treatment in adults has become more common. The most common orthodontic problems found in periodontally compromised patients include proclination of the maxillary anterior teeth, irregular interdental spacing, rotation, overeruption, migration, loss of teeth, and traumatic occlusion.[9]

However, several challenges are associated with the orthodontic treatment of periodontally compromised patients. First, the orthodontic force applied to achieve movement of teeth may aggravate periodontitis in patients with poor oral hygiene. Moreover, fixed appliances and wires make plaque control difficult. Orthodontic treatment is sometimes considered a predisposing factor for periodontal disease, as fixed orthodontic appliances with wire may inhibit plaque control, resulting in increased bacterial aggregation.[10] Second, a fixed appliance is not always aesthetically pleasing for adults, so prosthodontic rather than orthodontic treatments are often used.

However, orthodontic tooth movement may provide a substantial benefit in periodontal therapy. For example, anterior crowding may prevent patients from properly cleaning proximal tooth surfaces. The correction of these mal-positioned teeth permits better access for oral hygiene and can improve the morphology of marginal soft and hard tissues. Combined periodontal and orthodontic treatment has been shown to improve periodontal health and to re-establish well-functioning dentition.[11,12] After proper periodontal therapy, orthodontic treatment can improve both the alveolar bone and soft periodontal tissues.[13]

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Liu XF et al (2008)[14] evaluated the effect of combined periodontal-orthodontic treatment for patients who had chronic periodontitis with labial displacement of incisors and radiological evidence on migrated incisors. Twenty-one adult patients were included in the study. Fifty-two migrated incisors were randomly assigned to treatment with circumferential supracrestalfibrotomy or non-surgery. The mean orthodontic treatment time was 12 months. Before surgery (circumferential supracrestalfibrotomy) and at the end of orthodontic treatment, the following parameters were registered clinically: CAL(clinical attachment loss), TM(tooth mobility), SBI (sulcus bleeding index), PD (probing depth),CEJAC (distance from the CEJ to the alveolar crest) and RL (root length). Standardized intraoral radiographs were taken. SPSS12.0 software package was used for data analysis. Student's t test was performed for coupled data including PD, CAL, CEJAC and RL. Results of SBI and TM were analyzed statistically with Wilcoxon signed rank test. Comparison of pre- and post-treatment values showed a statistically significant improvement for all parameters without remarkable root apex resorption. TM and CAL reduction were greater in the surgical group compared to the non-surgical group ($P<0.05$). The reduction of CEJAC between the two groups were significantly different ($P<0.01$). The results show the efficacy of combined periodontal-orthodontic approach with circumferential fibrotomy on patients with incisors migration. After proper periodontal surgical therapy, orthodontic movement can positively improve both the alveolar bone and the soft periodontal tissues.

Han JY et al (2015).[15] The aim of this study was to evaluate the effect of orthodontic treatment on periodontal tissue and to compare orthodontic treatment with fixed appliances (FA) to clear aligner treatment (CAT) in periodontitis patients. A total of 35 patients who underwent orthodontic treatment in the Department of Periodontology were included in this study. After periodontal treatment with meticulous oral hygiene education, patients underwent treatment with FA or CAT, and this study analyzed patient outcomes depending on the treatment strategy. Clinical parameters were assessed at baseline and after orthodontic treatment, and the duration of treatment was compared between these two groups. The overall plaque index, the gingival index, and probing depth improved after orthodontic treatment. The overall bone level also improved ($P=0.045$). However, the bone level changes in the FA and CAT groups were not significantly different. Significant differences were found between the FA and CAT groups in probing depth, change in probing depth, and duration of treatment. However, no significant differences were found between the FA and CAT groups regarding the plaque index, changes in the plaque index, the gingival index, changes in the gingival index, or changes in the alveolar bone level. The percentage of females in the CAT group (88%) was significantly greater than in the FA group (37%). After orthodontic treatment, clinical parameters were improved in the FA and CAT groups with meticulous oral hygiene education and plaque control. Regarding plaque index and gingival index, no significant differences were found between these two groups. They suggest that combined periodontal and orthodontic treatment can improve patients' periodontal health irrespective of orthodontic techniques.

Conclusion

Following orthodontic treatment, there was a notable enhancement in clinical parameters within both the fixed appliance and clear alignment treatment groups, attributed to comprehensive oral hygiene education and effective plaque management. When examining the plaque index and gingival index, no significant disparities were observed between the two groups. It is proposed that an integrated approach to periodontal and orthodontic treatment can enhance the periodontal health of patients, regardless of the specific orthodontic methods employed.

References

1. Al-Anezi S.A. The effect of orthodontic bands or tubes upon periodontal status during the initial phase of orthodontic treatment. *Saudi Dent. J.* 2015;27:120–124.
2. Alfuriji S., Alhazmi N., Alhamlan N., Al-Ehaideb A., Alruwaithi M., Alkatheeri N., Geevarghese A. The effect of orthodontic therapy on periodontal health: A

review of the literature. *Int. J. Dent*. 2014;2014:585048.
3. Bollen A.M., Cunha-Cruz J., Bakko D.W., Huang G.J., Hujoel P.P. The effects of orthodontic therapy on periodontal health: A systematic review of controlled evidence. *J. Am. Dent. Assoc.* 2008;139:413–422.
4. Lang N.P., Bartold P.M. Periodontal Health. J. Periodontol. 2018;89:S9–S16.
5. Rossini G., Parrini S., Castroflorio T., Deregibus A., Debernardi C.L. Periodontal Health during Clear Aligners Treatment: A Systematic Review. Eur. J. Orthod. 2015;37:539–543.
6. Talic N.F. Adverse Effects of Orthodontic Treatment: A Clinical Perspective. Saudi Dent. J. 2011;23:55–59.
7. Giuca M.R., Pasini M., Drago S., del Corso L., Vanni A., Carli E., Manni A. Influence of Vertical Facial Growth Pattern on Herbst Appliance Effects in Prepubertal Patients: A Retrospective Controlled Study. Int. J. Dent. 2020;2020:1–8.
8. Martina S., Martini M., Bordegoni M., Razionale A.V. Predictability of Root Movements Using Virtual Root Setup in a Patient With Periodontal Disease Treated With Clear Aligners. Open Dent. J. 2021;15:605–611.
9. Gkantidis N, Christou P, Topouzelis N. The orthodontic-periodontic interrelationship in integrated treatment challenges: a systematic review. J Oral Rehabil. 2010;37:377–467.
10. Türkkahraman H, Sayin MO, Bozkurt FY, Yetkin Z, Kaya S, Onal S. Archwire ligation techniques, microbial colonization, and periodontal status in orthodontically treated patients. Angle Orthod. 2005;75:231–237.
11. Boyd RL, Leggott PJ, Quinn RS, Eakle WS, Chambers D. Periodontal implications of orthodontic treatment in adults with reduced or normal periodontal tissues versus those of adolescents. Am J Orthod Dentofacial Orthop. 1989;96:191–199.
12. Chou YH, Du JK, Chou ST, Hu KF, Tsai CC, Ho KY, et al. An interdisciplinary treatment approach combining orthodontic forced eruption with immediate implant placement to achieve a satisfactory treatment outcome: a case report. Clin Implant Dent Relat Res. 2013;15:113–133.
13. Liu XF, Pan XG, Shu R. A preliminary study of combined periodontal-orthodontic approach for treating labial displacement of incisors in patients with periodontal diseases. Shanghai Kou Qiang Yi Xue. 2008;17:264–270.
14. Liu XF, Pan XG, Shu R. [A preliminary study of combined periodontal-orthodontic approach for treating labial displacement of incisors in patients with periodontal diseases]. Shanghai Kou Qiang Yi Xue. 2008 Jun;17(3):264-6.
15. Han JY. A comparative study of combined periodontal and orthodontic treatment with fixed appliances and clear aligners in patients with periodontitis. J Periodontal Implant Sci. 2015 Dec;45(6):193-204.