

A Comparison of the Periodontal Health of Patients During Treatment with the Invisalign System and with Fixed Lingual Appliances

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ABSTRACT

Background: Fixed orthodontic appliances (FOA) promote the accumulation of bacterial plaque because FOA limit the ability of patients to perform good oral hygiene, which can lead to temporary destructive periodontal processes. A new system of thermoplastic clear aligner therapy, Invisalign®, was introduced to the field of orthodontics in 1997. It combines basic principles proposed by multiple orthodontic pioneers suggesting the use of a removable thermoplastic appliance to achieve orthodontic movement. Aim of the study: To compare the periodontal health of patients during treatment with the Invisalign system and with fixed lingual appliances.

Materials and methods: The present study was conducted in the Department of Orthodontics of the Dental institution. The ethical clearance for the study was approved from the ethical committee of the hospital. The selection was done on the basis of inclusion criteria. A total 30 adult patients between the ages of 18 and 50 who satisfied the inclusion criteria were recruited. The patients were assigned to 2 groups based on the treatment modality. The Invisalign group consisted of 15 patients and the conventional fixed group included 15 patients. The selected sample was analyzed with regards to demographics, particularly age, gender, income, educational level, and area of residence.

Results: The mean age of Invisalign group was 39.87 years and of conventional group was 41.27 years. In Invisalign group, the number of male patients was 6 and female patients was 9. In conventional group, the male patients were 7 in number and females were 8 in number. We observed that change in plaque index was more in conventional group. Furthermore, the change in gingival index was more evident in Invisalign group. The change in probing depth was significant in conventional group as compared to Invisalign group. The change in bone level was comparatively higher in conventional group. The mean duration of treatment for Invisalign treatment was 7.26 months and for conventional treatment was 5.68 months.

Conclusion: Within the limitations of the present study, it can be concluded that periodontal health improved with orthodontic treatment irrespective of the treatment method. However, the effect of probing defect was statistically significant on comparing the change in both the groups. Further studies are recommended.

Keywords: Orthodontic treatment, Invisalign, Fixed orthodontic treatment.

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INTRODUCTION

Fixed orthodontic appliances (FOA) promote the accumulation of bacterial plaque because FOA limit the ability of patients to perform good oral hygiene, which can lead to temporary destructive periodontal processes.^{1, 2} Deterioration of the periodontal status and dental decalcification during orthodontic treatment can be avoided only when the patient is incorporated in a stringent recall system.³ Recent developments in the field of orthodontics have led to major changes in patients' interest in orthodontic therapy. A new system of thermoplastic clear aligner therapy, Invisalign® (Align Technology, Inc., Santa Clara, CA, USA), was introduced to the field of orthodontics in 1997.⁴ It combines basic principles proposed by multiple orthodontic pioneers suggesting the use of a removable thermoplastic appliance to achieve orthodontic movement.⁵ Invisalign aligners consist of a series of clear, removable, plastic appliances that the patient wears sequentially to achieve the final result. The Invisalign system uses a computer-based online software to plan the treatment ahead of time and the orthodontist can share the expected final results with the patients.⁶ Hence, the present study was conducted to compare the periodontal health of patients during treatment with the Invisalign system and with fixed lingual appliances.

MATERIALS AND METHODS

The present study was conducted in the Department of Orthodontics of the Dental institution. The ethical clearance for the study was approved from the ethical committee of the hospital. The selection was done on the basis of inclusion criteria.

Inclusion criteria:

- Treatment involved both jaws, treatment did not involve tooth extraction, crowding or spacing limited to 1–4 mm,
- Angle Class I molar relationship without skeletal discrepancy,
- Absence of vertical or transverse discrepancy,
- Absence of periodontal disease, and
- Full complement of dentition except for 3rd molars.

A total 30 adult patients between the ages of 18 and 50 who satisfied the inclusion criteria were recruited. The patients were assigned to 2 groups based on the treatment modality. The Invisalign group consisted of 15 patients and the conventional fixed group included 15 patients. This observational study was conducted using the previously structured and validated oral health-related quality of life (OHRQoL) questionnaire. It also assesses pain severity and the use of pain-relieving medications. The degree of pain was assessed using a visual analog scale of 1–10 with 1–3 representing mild pain, 4–7 moderate pain, and 8–10 severe pain. Analgesic consumption was based on patients' self-reports. Patients were asked to fill out the questionnaire 1 week after their routine orthodontic visit. The selected sample was analyzed with regards to demographics, particularly age, gender, income, educational level, and area of residence. The data were collected from the participants through self-reported questionnaire after their routine appointment. An informed consent was attached to the questionnaire clearly stating the importance of patient privacy and the confidential information provided.

The statistical analysis of the data was done using SPSS version 11.0 for windows. Chi-square and Student's t-test were used for checking the significance of the data. A p-value of 0.05 and lesser was defined to be statistically significant.

RESULTS

A total of 30 patients were selected for the study on comparing periodontal effects of Invisalign and fixed orthodontic treatment. Table 1 and Fig 1 shows the demographic data of both the groups. We observed that 15 patients were present in each group. The mean age of Invisalign group was 39.87 years and of conventional group was 41.27 years. In Invisalign group, the number of male patients was 6 and female patients was 9. In conventional group, the male patients were 7 in number and females were 8 in number. Table 2 shows the comparison of periodontal effect of orthodontic treatment in Invisalign group and conventional group. We observed that change in plaque index was more in conventional group. Furthermore, the change in gingival index was more evident in Invisalign group. The change in probing depth was significant in

conventional group as compared to Invisalign group.

Table 1: Demographic data.

Parameters	Invisalign group	Conventional group
Number of patients	15	15
Mean age (years)	39.87	41.27
Number of male patients	6	7
Number of female patients	9	8

Fig 1: Demographics.

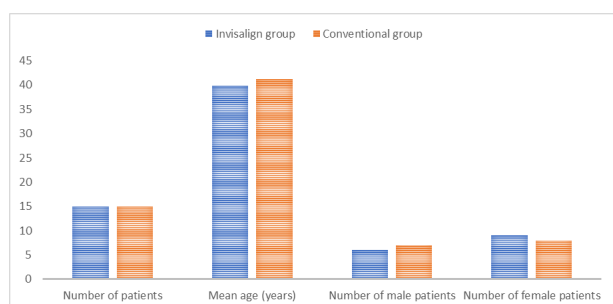
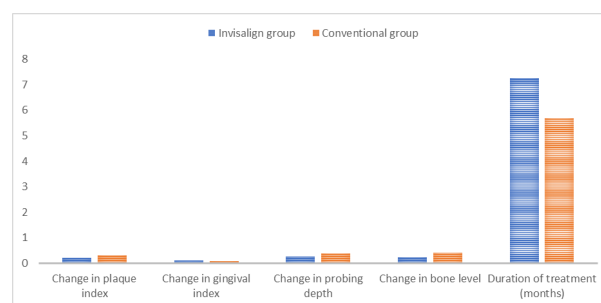


Table 2: Comparison of periodontal effect of orthodontic treatment in Invisalign group and conventional fixed appliance treatment.

Clinical parameters	Invisalign group	Conventional group	p-value
Change in plaque index	0.21	0.32	0.26
Change in gingival index	0.11	0.08	0.31
Change in probing depth	0.26	0.38	0.05
Change in bone level	0.25	0.41	0.52
Duration of treatment (months)	7.26	5.68	0.02

Fig 2: Periodontal effect of in Invisalign group and conventional group.



The change in bone level was comparatively higher in conventional group. The mean duration of treatment for Invisalign treatment was 7.26 months and for conventional treatment was 5.68 months. The results on comparison were statistically significant for change in probing depth. [Fig 2]

DISCUSSION

The aim of this study was to study the periodontal effect of orthodontic treatment with Invisalign and conventional fixed treatment. After orthodontic treatment, the overall plaque index, gingival index, and probing depth improved. The overall bone level also improved. The probing depth changes over the course of treatment showed significant differences on comparison between both the groups. The plaque index, gingival index and bone level improved in both groups following orthodontic treatment, but no statistically significant differences were observed between groups. The results were compared with previous studies and was found to be consistent with results. Miethke RR et al designed a concomitant trial of two groups of consecutive patients. The lingual patients were evaluated between February and May 2005. Thirty patients each with aligners or fixed lingual appliances were examined at three consecutive control visits for their periodontal status. All the Invisalign patients and some of those wearing lingual appliances were patients from the Department of Orthodontics and Dentofacial Orthopedics of the Charité Berlin. The rest were recruited from the practices of two licensed orthodontists. The patients' periodontal health was evaluated in reference to a modified Gingiva, modified Plaque and modified Papillary Bleeding Index; we also measured the sulcus probing depth. All indices were documented buccally in the 1st and 3rd quadrants, and lingually in the 2nd and 4th

quadrants from central incisor to first molar. The sulcus probing depth was measured mesially, distally, buccally and lingually in each quadrant's first molar and first premolar. Each control visit was concluded with detailed, individualized instructions in oral hygiene. Overall, the Invisalign patients demonstrated significantly better modified indices. However, the sulcus probing depths were very similar in both treatment groups. They concluded that although all the teeth and parts of the keratinized gingiva are covered nearly all day during Invisalign treatment, the periodontal risk is lower than that associated with fixed lingual appliances. This may be due to the fact that aligners are removable, permitting unimpeded oral hygiene. In contrast, the lingual tooth surfaces are very difficult to clean when fitted with a fixed appliance. Lu H et al studied the periodontal health status of patients undergoing orthodontic treatment with fixed appliances and invisalign. Meta-analysis results showed that there was no statistically significant difference of gingival index (GI) and sulcus probing depth (SPD) status between the invisalign group and the control group, including at 1, 3, and 6 months. When compared with the control group, the invisalign group presented a lower plaque index (PLI) and sulcus bleeding index (SBI) status at 1 month, 3 months, and 6 months. Subgroup analysis showed that the SPD status was lower in the invisalign group at 6 months when measured the teeth using Ramfjord index. However, there was no statistically significant difference between the 2 groups when using other measure methods. They concluded that comparing with the traditional fixed appliances, patients treated with invisalign have a better periodontal health. However, more studies are needed to confirm this conclusion in the future.^{7,8}

Miethke RR et al evaluated periodontal health in patients during treatment with either fixed orthodontic appliances or the Invisalign system. The study was designed as a concomitant trial. The evaluation of the patients started in February 2002 and was completed in August 2003. Thirty consecutive patients each with fixed orthodontic appliances and with aligners were examined at three consecutive control visits for their periodontal condition. All individuals were part of the clientele of the Department of Orthodontics and Dentofacial Orthopedics of the Charité Berlin. The parameters

evaluated were the modified Gingival Index, modified Plaque Index, modified Papillary Bleeding Index, and sulcus probing depth. The first three indices were recorded alternatively buccally and lingually in all permanent teeth from central incisor to first molar: buccally in the maxillary right and the mandibular left quadrants, lingually in the maxillary left and mandibular right quadrants. The sulcus depth was measured in four areas: mesially and distally, lingually and buccally in the 1st molar and the 1st premolar of each quadrant. Each control visit was concluded with a detailed, individualized oral hygiene instruction. The modified Plaque Index was significantly lower in the Invisalign group overall. On the other hand, the periodontal condition of the two samples was nearly identical. They concluded that periodontal health is not jeopardized, even though the Invisalign system aligners cover all the teeth and the keratinized gingiva in part. This could be attributed to the fact that aligners are removable and thus allow unimpeded oral hygiene. Han JY et al evaluated 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. 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. They concluded that 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.^{9,10}

CONCLUSION

Within the limitations of the present study, it can be concluded that periodontal health improved with orthodontic treatment irrespective of the treatment method. However, the effect of probing defect was statistically significant on comparing the change in both the groups. Further studies are recommended.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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