

A retrospective study of orthodontic treatment on anterior tooth displacement caused by periodontal disease

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Abstract

This retrospective study aimed to explore the effect of orthodontic treatment (ODT) on anterior tooth displacement (ATD) caused by periodontal disease (PD).

A total of 72 patients were selected and were divided into a control group (n=36) and an experimental group (n=36). Patients in both groups received conventional periodontal treatment. In addition, patients in the experimental group also received ODT. Outcomes include probing depth, percentage of bleeding sites, clinical attachment loss, clinical crown length, tooth root length, and periodontal tissue of the affected tooth (alveolar bone height, periodontal pocket depth, bleeding index).

After treatment, the patients in the experimental group achieved more improvements in probing depth ($P < .01$), percentage of bleeding sites ($P < .01$), clinical attachment loss ($P < .01$), clinical crown length ($P = .04$), and periodontal tissue of the affected tooth (periodontal pocket depth ($P < .01$), and bleeding index ($P < .01$)), than those of patients in the control group.

This study suggests that ODT is beneficial for ATD caused by PD. Future studies are still needed to verify the findings of this study.

Abbreviations: ATD = anterior tooth displacement, ODT = orthodontic treatment, PD = periodontal disease.

Keywords: anterior tooth displacement, effect, orthodontic treatment, periodontal disease

1. Introduction

Periodontal disease (PD) is one of the most common conditions of the oral cavity,^[1-4] which is the second leading cause of teeth loss.^[5] It consists of gingiva and periodontitis.^[3,6,7] Gingivitis is the mildest type of PD, which involves gums only.^[3,6,7] Periodontitis is a chronic, destructive, and irreversible inflammatory disease.^[3,6-10] It usually accumulates deep periodontal tissue, including gums (gingiva), alveolar bone, cementum, and periodontal ligament.^[3,6-10] PD has very high incidence around the world, and its incidence rate arises with the age increasing.^[11-13] It is estimated that more than 90% general population are subjected to PD.^[1,6,8,14] If it can not be treated very well, it may

cause a variety of disorders, such as anterior tooth displacement (ATD).

At present, the available treatments for PD mainly include conventional periodontal therapy, medication, surgery, and periodontal tissue regeneration.^[15-19] As for ATD management, orthodontic treatment (ODT) is a common utilized modality.^[20-22] It is utilized to straight or to move teeth in order to enhance their appearance and function. It can help keep the health of teeth, gums, and jaw joints. However, there is limited evidence on the effect of ODT for treating ATD after PD. Therefore, this retrospective study investigated the effect of ODT for the treatment of patients with ATD following PD.

2. Methods

2.1. Ethical approval

The Medical Ethical Committee of Changzhou No. 2 People's Hospital has approved the analysis and waived informed consent.

2.2. Design

This retrospective cohort study was set up by analyzing clinical outcome data. All data came from Changzhou No. 2 People's Hospital. The treatment range was between March 2018 and December 2019. A total of 72 eligible patient cases were included in this study, and were divided into a control group (n=36) and experimental group (n=36) based on the different modalities they received. All patients in both groups received conventional periodontal treatment. Additionally, patients in the experimental group also underwent ODT. Patients and researchers were not masked in this retrospective study, because all data we harvested from already completed patient case records. However, the data analyst was blinded in this study.

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The authors have no conflicts of interests to disclose.

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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2.3. Patients

The primary inclusion criteria were as follows: patients with ATD caused by PD according to the diagnostic criteria of Guidelines for Prevention and Treatment of Periodontal Disease in China^[2,3]; aged between 18 and 70 years old; and completed case records without insufficient information. The exclusion criteria were as follow: those with 1 or more tooth missing per quadrant, previously orthognathic surgery, and ATD caused by other factors or reasons, besides PD.

2.4. Intervention

All eligible patients had received conventional periodontal treatment. It includes oral cleaning, periodontal and root surface treatment, and medication. The oral cleaning therapy consists of oral hygiene related knowledge and education, and effective oral cleaning methods. The periodontal and root surface treatment includes subgingival scraping, supragingival cleansing, tooth root surface grinding, caries removal and bad restoration, periodontal pocket washing, and restoration of periodontal and endodontic affected tissues.

Besides the conventional periodontal treatment, patients in the experimental group also received ODT. The straight wire arch correction technique was used to bond the molars to the buccal canal, and the straight wire technique was used to bond the brackets to the attacked teeth. The affected anterior teeth were corrected with titanium nickel round wires, and the upper and lower sides were lowered with multi-curved labial arches. Then, the front teeth were ligated the canines to enhance stability, and a rubber chain was hung between the canines on both sides to make the front teeth adduct. Finally, retainers were used to keep the teeth fixed, and lingual fixation and periodontal splints were separated.

2.5. Outcome measurements

The primary outcomes are probing depth, percentage of bleeding sites, clinical attachment loss. The secondary outcomes are clinical crown length, tooth root length, and periodontal tissue of the affected tooth (alveolar bone height, periodontal pocket depth, bleeding index).

2.6. Statistical analysis

This study employed SPSS software (SPSS V.19.0, IBM Corp., Armonk, NY) to perform statistical analysis. We used *t* test or Mann–Whitney *U* test to analyze the continuous data based on whether it was the normally distributed or non-normally distributed one, respectively. We exploited χ^2 test or Fisher exact test to analyze categorical data. A 2-side $P < .05$ was defined as having statistical significance.

3. Results

We included a total of 72 patients with ATD caused by PD. They were allocated to a control group ($n=36$) and as experimental group ($n=36$) based on the different treatments they received. All patient characteristics and demographics in both groups are summarized in Table 1. There were not significant differences in all of those information between 2 groups (Table 1).

Before treatment, there were not significant differences in both primary outcomes (probing depth ($P=.59$), percentage of

Table 1

Patient characteristics at baseline.

Characteristics	Experimental group (n = 36)	Control group (n = 36)	P
Age (years)	46.1 (8.3)	44.8 (9.4)	.53
Gender			
Male	21 (58.3)	22 (61.1)	.81
Female	15 (41.7)	14 (38.9)	—
Bleeding index (degree)			
<3	19 (52.8)	20 (55.6)	.81
≥4	17 (47.2)	16 (44.4)	—
Anterior teeth displacement			
Lip forward	13 (36.1)	16 (44.4)	.47
Titled teeth	21 (58.3)	18 (50.0)	.48
Teeth twist	10 (27.8)	12 (33.3)	.61
Anterior teeth elongation	13 (36.1)	15 (41.7)	.63
Degree of deep overbite			
I	20 (55.6)	18 (50.0)	.64
II	11 (30.6)	14 (38.9)	.46
III	5 (13.9)	4 (11.1)	.72

Data are present as mean ± standard deviation or number (%).

bleeding sites ($P=.15$), clinical attachment loss ($P=.72$); Table 2), and secondary outcomes (clinical crown length [$P=.74$], tooth root length [$P=.86$]), and periodontal tissue of the affected tooth [alveolar bone height [$P=.11$], periodontal pocket depth [$P=.45$], bleeding index [$P=.39$]; Table 3)] between 2 groups.

After treatment, there were significant differences between primary outcomes (probing depth ($P < .01$), percentage of bleeding sites ($P < .01$), clinical attachment loss ($P < .01$), Table 2), and secondary outcomes (clinical crown length [$P=.04$], and periodontal tissue of the affected tooth [periodontal pocket depth [$P < 0.01$], bleeding index [$P < 0.01$]], Table 3) between 2 groups.

4. Discussion

PD is a common disease in dentistry.^[1,2] It usually occurs after oral anaerobic bacteria infection.^[1–3] It includes various diseases of periodontal supporting tissues, such as gums, alveolar bone, periodontal ligament, and cementum diseases.^[3,6,7] It mainly manifests as gingival recession and alveolar bone resorption.^[3,6,7] If it can not be treated effectively and timely, it may result in poor quality of life in such patients.

Table 2

Comparison of primary outcome measurements between 2 groups.

Outcomes	Experimental group (n = 36)	Control group (n = 36)	P
Before treatment			
Probing depth (mm)	3.42 (0.51)	3.35 (0.58)	.59
Percentage of bleeding sites	58.35 (7.64)	55.72 (7.83)	.15
Clinical attachment loss (mm)	2.53 (0.57)	2.48 (0.62)	.72
After treatment			
Probing depth (mm)	2.10 (0.36)*	2.57 (0.42)*	<.01
Percentage of bleeding sites	36.28 (8.11)*	44.19 (8.03)*	<.01
Clinical attachment loss (mm)	1.70 (0.52)*	1.88 (0.59)*	<.01

Data are present as mean ± standard deviation or number (%).

* $P < .01$, compared before treatment.

Table 3**Comparison of secondary outcome measurements between 2 groups.**

Outcomes	Experimental group (n=36)	Control group (n=36)	P
Before treatment			
Clinical crown length (mm)	8.74 (1.62)	8.61 (1.74)	.74
Tooth root length (mm)	11.44 (1.23)	11.49 (1.16)	.86
Periodontal tissue of the affected tooth			
Alveolar bone height (mm)	5.30 (0.14)	5.31 (0.18)	.11
Periodontal pocket depth (mm)	6.38 (0.21)	6.42 (0.24)	.45
Bleeding index	81.26 (7.10)	79.84 (6.91)	.39
After treatment			
Clinical crown length (mm)	7.01 (1.55)*	7.79 (1.63)†	.04
Tooth root length (mm)	11.21 (1.30)	11.40 (1.27)	.53
Periodontal tissue of the affected tooth			
Alveolar bone height (mm)	5.28 (0.18)	5.30 (0.15)	.61
Periodontal pocket depth (mm)	3.40 (0.10)*	4.45 (0.13)*	<.01
Bleeding index	56.74 (4.28)*	69.21 (5.02)*	<.01

Data are present as mean ± standard deviation or number (%).

* P < .01, compared before treatment.

† P < .05, compared before treatment.

Treatments for PD mainly focus on eliminating inflammation, controlling its further occurrence and development, and stabilizing the local micro-environment of periodontal tissue, and the later ODT.^[15–19] Previous studies reported that ODT can benefit patients with ATD after PD.^[20–22] However, there is insufficient evidence to support this issue.

In this retrospective study, we explored the effect of ODT for the treatment of patients with ATD caused by PD. The results of this study showed that ODT plus conventional periodontal treatment exerted better effects in probing depth, percentage of bleeding sites, clinical attachment loss, clinical crown length, and periodontal tissue of the affected tooth (periodontal pocket depth, bleeding index), than conventional periodontal treatment alone. It indicates that ODT may benefit patients with ATD after PD.

The strength of this manuscript was that it specifically focused on Chinese patients, and included Chinese patients only in this study, which help to decrease the variability of this study. The disadvantages of this retrospective study were as follows: First, this study had a relatively short observation duration, and no further follow-up outcome data was recorded. Future studies are needed to elaborate the existing obscures. Second, the sample size of this study was quite small, which may affect its findings. Third, all patient data was collected from 1 center of Changzhou No. 2 People's Hospital, which may affect its generalization to other hospitals. Finally, as a retrospective study, it failed to perform randomization, blind, power calculation, and treatment effect size for statistical calculations.

5. Conclusion

Our findings demonstrate that ODT may benefit patients with ATD caused by PD. More studies without above restrictions should focus on investigating this topic.

Author contributions

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