

Clinical Effect of Orthodontic Treatment for Anterior Tooth Displacement Caused by Periodontitis

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Abstract: *Objective:* To investigate the clinical efficacy of orthodontic treatment for anterior tooth displacement caused by periodontitis. *Methods:* Seventy patients with anterior tooth displacement caused by periodontitis admitted to our hospital from October 2021 to February 2024 were randomly divided into a control group and an observation group, with 35 cases in each group. The control group received basic periodontal treatment, while the observation group received orthodontic treatment. The pain level, tooth function, periodontal condition, and inflammatory factor levels of the two groups were compared before and after treatment. *Results:* The pain level of the observation group after treatment was significantly lower than that of the control group ($P < 0.05$); tooth function was significantly better than the control group ($P < 0.05$); the height of anterior alveolar bone and the depth of periodontal pocket were both lower than the control group ($P < 0.05$); and the level of inflammatory factors was lower than the control group ($P < 0.05$). *Conclusion:* Orthodontic treatment for anterior tooth displacement caused by periodontitis is effective and can significantly improve patients' tooth function and periodontal condition, reduce pain, and lower inflammatory response, with high clinical application value.

Keywords: Orthodontics; Periodontitis; Anterior tooth displacement; Clinical efficacy

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1. Introduction

In the field of modern dentistry, periodontitis, as a common chronic disease, not only threatens patients' oral health but can also lead to a series of secondary problems, among which anterior tooth displacement is one of the most direct and visually impactful complications. The alveolar bone resorption and periodontal tissue destruction caused by periodontitis make the teeth lose their original stable support, leading to displacement^[1], which not only affects patients' chewing efficiency and clarity of speech but also seriously damages facial aesthetics, reducing patients' self-confidence and quality of life^[2]. Traditionally, the treatment of periodontitis has focused on controlling inflammation and restoring the health of periodontal tissues, while there has often been a lack of effective solutions

for the resulting tooth displacement. However, with the continuous development and improvement of orthodontic technology, especially the application of modern orthodontic methods such as straight wire orthodontics, new treatment options have been provided for patients with anterior tooth displacement caused by periodontitis. Orthodontic treatment can not only realign misaligned teeth and improve occlusal relationships but also promote the regeneration and repair of periodontal tissues to a certain extent, bringing comprehensive improvement to the treatment of periodontitis. In view of this, this paper aims to explore the therapeutic effect of orthodontic treatment for anterior tooth displacement caused by periodontitis through a comprehensive analysis of clinical practice, in order to further optimize the treatment plan and improve the treatment effect and quality of life of patients with anterior tooth displacement caused by periodontitis.

2. Materials and methods

2.1. General information

A total of 70 patients with anterior tooth displacement caused by periodontitis admitted to Huangpu District Stomatological Disease Prevention Institute from October 2021 to October 2024 were selected. Patients were randomly divided into a control group and an observation group using a random number table, with 35 cases in each group.

Inclusion criteria: (1) Clinically diagnosed with periodontitis and accompanied by anterior tooth displacement; (2) Patients voluntarily signed informed consent forms and could cooperate with the entire treatment and follow-up process.

Exclusion criteria: (1) Patients with severe systemic diseases, such as uncontrolled diabetes, cardiovascular diseases, etc., which may affect the outcome of periodontal or orthodontic treatment; (2) Pregnant or lactating women; (3) Absolute contraindications for orthodontic treatment, such as severe temporomandibular joint disorders; (4) Patients with mental disorders or cognitive impairment who cannot understand and follow the treatment plan.

2.2. Methods

2.2.1. Control group

The control group received basic periodontal treatment, including:

- (1) Oral health education: Patients were given detailed explanations about the causes and harms of periodontitis and the correct methods of maintaining oral hygiene, including the correct brushing method (Bass method), and the use of dental floss and interdental brushes. The importance of maintaining good oral hygiene habits for the treatment and prevention of the recurrence of periodontal disease was emphasized.
- (2) Supragingival scaling: Ultrasonic scalers were used to remove supragingival calculus, plaque, and pigmentation. During the operation, attention was paid to adjusting the power and angle of the working tip to avoid damaging the gingival tissue ^[3].
- (3) Subgingival curettage and root planing: Under local anesthesia, subgingival curettes and root planers were used to carefully remove subgingival calculus, diseased cementum, and inflammatory granulation tissue in the periodontal pocket, making the root surface smooth and flat, which was conducive to periodontal tissue healing. After treatment, patients were given oral local rinses and applied iodine glycerin and other

anti-inflammatory drugs.

- (4) Regular follow-up: After treatment, patients were required to have a follow-up examination every 3 months to check the periodontal condition, and if necessary, perform re-cleaning or other periodontal maintenance treatment, and continue to observe for 1 year.

2.2.2. Observation group

The observation group received orthodontic treatment, the specific steps were as follows:

- (1) Comprehensive examination and evaluation: Before treatment, patients underwent a detailed oral examination to fully understand the patient's tooth alignment, alveolar bone height and density, root morphology and length, and the degree of periodontal tissue destruction.
- (2) After routine periodontal treatment, fixed orthodontic appliances were used for orthodontic treatment: The straight wire technique was used to initially align and level the teeth, and buccal tubes were bonded on the first and second molars to avoid malocclusion of the posterior teeth and cause trauma. During the entire orthodontic process, a 100–150g orthodontic traction force was used in combination with a stainless steel method, and the sliding method was gradually used to close the scattered gaps caused by periodontitis. With the help of good anchorage control, a good anterior tooth overlap and coverage relationship was finally established to ensure that the direction and speed of tooth movement were as expected. After the completion of orthodontic treatment, stainless steel ligature “8” knots were used for fixation for 1–3 months, and then the orthodontic appliance was removed and a Hawley retainer was worn to ensure that the teeth were stabilized in the new position. X-rays and intraoral and facial photographs were taken before and after treatment. After the completion of orthodontic treatment, follow-up examinations were conducted every 3 months to perform periodontal-related examinations and observe the growth of the alveolar process to prevent recurrence of the disease.

2.3. Observation indicators

- (1) General information: including gender, age, and degree of anterior tooth displacement.
- (2) Pain assessment: The visual analog scale (VAS) was used to assess the patient's pain level during treatment, with 0 points indicating no pain and 10 points indicating severe pain. Patients were asked to self-assess and record their pain level 1 day, 3 days, and 7 days after treatment.
- (3) Assessment of tooth function: The oral function scale was used to evaluate the patient's tooth function before and after treatment. This index includes the evaluation of chewing function, comfort, fixed function, and aesthetic function (0–10 points), with higher scores indicating poorer tooth function.
- (4) Assessment of periodontal condition: The height of the anterior alveolar bone and the depth of the periodontal pocket were measured before and 6 months after treatment.
- (5) Detection of inflammatory factor levels: Venous blood was collected from fasting patients in the morning before and after treatment, and the levels of interleukin-6 (IL-6), interleukin-8 (IL-8), and tumor necrosis factor- α (TNF- α) in serum were detected by enzyme-linked immunosorbent assay (ELISA).

2.4. Statistical analysis

SPSS 25.0 software was used for data analysis. Measurement data were expressed as mean \pm standard deviation (SD), and inter-group comparisons were performed using independent sample *t*-tests and χ^2 tests. $P < 0.05$ was

considered statistically significant.

3. Results

3.1. Comparison of general data between the two groups

There was no statistically significant difference in general data such as gender, age, and degree of anterior tooth displacement between the two groups ($P > 0.05$), indicating that the two groups were comparable.

Table 1. Comparison of general data between the two groups

Group	n	Gender		Age (mean \pm SD, years)	Degree of anterior tooth displacement		
		Male	Female		Mild	Moderate	Severe
Control	35	20	15	42.51 \pm 8.32	10	15	10
Observation	35	21	14	43.21 \pm 7.92	10	17	8
χ^2 / t			0.059	0.385		0.347	
<i>P</i>			0.808	0.701		0.841	

3.2. Comparison of pain levels between the two groups

The VAS scores of the observation group 1 day, 3 days, and 7 days after treatment were significantly lower than those of the control group ($P < 0.05$). Specific data are shown in **Table 2**.

Table 2. Comparison of pain level between the two groups (mean \pm SD)

Group	1 day after treatment	3 days after treatment	7 days after treatment
Control	4.21 \pm 1.32	3.56 \pm 1.16	2.81 \pm 0.90
Observation	3.03 \pm 1.12	2.25 \pm 0.89	1.51 \pm 0.60
<i>t</i>	4.033	5.301	7.110
<i>P</i>	0.000	0.000	0.000

3.3. Comparison of tooth function before and after treatment between the two groups

After treatment, the scores of all tooth function items in the observation group were higher than those in the control group ($P < 0.05$). Specific data are shown in **Table 3**.

Table 3. Comparison of tooth function before and after treatment between the two groups (mean \pm SD)

Group	Chewing function		Comfort		Fixation		Aesthetics	
	Before	After	Before	After	Before	After	Before	After
Control	2.66 \pm 0.41	3.05 \pm 0.72	2.56 \pm 0.41	2.68 \pm 0.53	2.30 \pm 0.46	2.66 \pm 0.41	2.98 \pm 0.52	3.28 \pm 0.66
Observation	2.65 \pm 0.44	3.46 \pm 0.82	2.55 \pm 0.43	4.32 \pm 0.77	2.32 \pm 0.44	3.65 \pm 0.68	2.99 \pm 0.51	3.85 \pm 0.77
<i>t</i>	0.098	2.223	0.100	10.379	0.186	7.376	0.071	3.325
<i>P</i>	0.922	0.030	0.921	0.000	0.853	0.000	0.944	0.001

3.4. Comparison of periodontal conditions before and after treatment between the two groups

After treatment, the height of the anterior alveolar bone and the depth of the periodontal pocket in the observation group were both lower than those in the control group, and the difference was statistically significant (both $P < 0.05$). Specific data are shown in **Table 4**.

Table 4. Comparison of periodontal conditions before and after treatment between the two groups (mean \pm SD)

Group	Height of anterior alveolar bone (mm)		Depth of periodontal pocket (mm)	
	Before	After	Before	After
Control	5.15 \pm 1.43	4.85 \pm 1.40	4.95 \pm 1.41	4.25 \pm 1.25
Observation	5.14 \pm 1.44	4.11 \pm 1.30	4.96 \pm 1.43	3.62 \pm 1.01
<i>t</i>	0.029	2.292	0.030	2.319
<i>P</i>	0.977	0.025	0.977	0.023

3.5. Comparison of inflammatory factor levels before and after treatment between the two groups

After treatment, the levels of serum IL-6, IL-8, and TNF- α in the observation group were all significantly lower than those in the control group (all $P < 0.05$). Specific data are shown in **Table 5**.

Table 5. Comparison of inflammatory factor levels before and after treatment between the two groups (mean \pm SD)

Group	IL-6		IL-8		TNF- α	
	Before	After	Before	After	Before	After
Control	4.22 \pm 1.35	3.57 \pm 1.05	7.76 \pm 1.26	6.28 \pm 1.12	5.30 \pm 1.46	4.06 \pm 1.25
Observation	4.23 \pm 1.37	3.11 \pm 0.82	7.75 \pm 1.28	5.32 \pm 1.07	5.32 \pm 1.44	3.45 \pm 1.03
<i>t</i>	0.031	2.043	0.033	3.667	0.058	2.228
<i>P</i>	0.976	0.045	0.974	0.001	0.954	0.029

4. Discussion

Periodontitis is a common chronic infectious disease of the oral cavity. Its main pathological features include inflammation and destruction of periodontal supporting tissues. If left untreated, it can lead to tooth loosening, displacement, and even loss. Anterior tooth displacement is one of the common manifestations of late-stage periodontitis, which not only affects the patient's aesthetics and pronunciation but also seriously damages the chewing function of the teeth, reducing the patient's quality of life.

Traditional basic periodontal treatment mainly focuses on controlling periodontal inflammation, eliminating periodontal pockets, and promoting the repair of periodontal tissues. However, for anteriorly displaced teeth, it is often difficult to restore them to their normal position and function^[5]. Orthodontic treatment, on the other hand, can guide displaced anterior teeth to gradually move back to their normal position in the dental arch by applying appropriate orthodontic forces, while improving the occlusal relationship of the teeth and restoring the chewing

function of the teeth ^[6].

The results of this study showed that the pain level of the observation group was significantly lower than that of the control group after orthodontic treatment. This may be because the orthodontic treatment followed the principle of light force in designing the treatment plan, and the orthodontic force could be adjusted in time according to the patient's periodontal condition during the treatment process, avoiding excessive damage to the periodontal tissue and pain caused by excessive orthodontic force. In terms of tooth function, the scores of all tooth function items in the observation group were significantly higher than those in the control group after treatment, indicating that orthodontic treatment could better restore the chewing, pronunciation, and other functions of the patient's teeth. This is because after orthodontic treatment restores the displaced anterior teeth to their normal position, the occlusal relationship of the teeth is improved, thereby improving the functional efficiency of the teeth ^[7,8]. In terms of periodontal conditions, the height of the anterior alveolar bone and the depth of the periodontal pocket in the observation group were both lower than those in the control group after treatment. This shows that orthodontic treatment can not only correct anterior tooth displacement but also has a positive promoting effect on the health of periodontal tissues. The mechanism may be that orthodontic treatment adjusts the direction and distribution of the force on the teeth, redistributes the stress of the periodontal tissue, and is beneficial to the blood circulation and metabolism of the periodontal tissue, promoting the repair and regeneration of the periodontal tissue ^[9]. In addition, this study also found that the levels of IL-6, IL-8, and TNF- α in the observation group were significantly lower than those in the control group after treatment. Inflammatory factors play an important role in the occurrence and development of periodontitis. They can promote the infiltration and activation of inflammatory cells and aggravate the destruction of periodontal tissues. Orthodontic treatment may reduce the local stimulation of periodontal tissues by improving the arrangement and occlusion of teeth, thereby reducing the production and release of inflammatory factors and alleviating the inflammatory response of periodontal tissues ^[10].

5. Conclusion

In conclusion, orthodontic treatment for anterior tooth displacement caused by periodontitis is effective. However, the formation of periodontitis is complex and is greatly influenced by factors such as the patient's oral hygiene status, the patient's cultural level, and systemic diseases. Orthodontic treatment still requires extra caution. It is necessary to carefully select indications, conduct a comprehensive evaluation before treatment, formulate individualized plans, and closely monitor the periodontal condition to ensure the safety and effectiveness of treatment. After treatment, patients should maintain good oral hygiene and have regular check-ups to prevent recurrence. Due to the relatively small sample size and short observation time of this study, more large-sample studies need to be carried out in the future to further explore the long-term effects and mechanisms of orthodontic treatment, providing evidence for clinical treatment.

Disclosure statement

The author declares no conflict of interest.

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