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The Effect of Occlusal Adjustment on Periodontal Treatment Outcomes in Patients with Chronic Periodontitis and Occlusal Trauma

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Abstract

Objective: To investigate the effect of occlusal intervention combined with basic periodontal treatment on patients with chronic periodontitis complicated by occlusal abnormalities, and to provide evidence-based support for clinical practice. **Methods:** Sixty patients with chronic periodontitis accompanied by occlusal dysfunction who visited our hospital from January to December 2023 were selected as study samples and randomly divided into an experimental group (n=30) and a control group (n=30). The control group received standard periodontal basic treatment (including supragingival cleaning, subgingival scaling, and root planing), while the experimental group received additional occlusal function correction (involving early contact point modification, elimination of occlusal interference, and reconstruction of occlusal stability) based on the standard treatment. The periodontal status indicators (including probing depth PD, attachment level AL, and gingival bleeding index GBI) and overall treatment efficacy were evaluated in both groups before and after 3 months of treatment. **Results:** Before treatment, there were no significant differences in the detection data of periodontal probing depth (PD), attachment loss (AL), and gingival bleeding index (GBI) between the two groups (P>0.05). After 3 months of treatment, the experimental group showed significantly better results in terms of PD, AL, and GBI compared to the control group, with statistically significant differences (P<0.05). Additionally, the overall treatment efficacy rate in the experimental group was significantly higher than that in the control group (P<0.05). **Conclusion:** For patients with chronic periodontitis complicated by occlusal trauma, occlusal adjustment intervention supplemented with standard periodontal treatment can effectively improve the health status of periodontal tissues and significantly enhance clinical efficacy. It is worth promoting and applying in clinical practice.

Keywords: chronic periodontitis, occlusal trauma, occlusal adjustment, periodontal probing depth, attachment loss, treatment outcome

0. Introduction

Chronic periodontitis is a global oral disease primarily affecting middle-aged and elderly populations. Approximately 30% to 50% of the general population is susceptible to this disease. The main pathological mechanism of the disease is the continuous accumulation of dental plaque biofilm, which leads to gingival inflammation, the formation of periodontal pockets, and resorption of the alveolar bone, ultimately threatening the stability of the teeth. This disease not only disrupts chewing function but can also induce systemic inflammatory reactions through blood circulation, greatly increasing the risk of cardiovascular diseases and systemic diseases such as diabetes. In recent years, with the continuous advancement of research in oral medicine, occlusal trauma has been recognized as one of the key contributing factors to chronic periodontitis and has been included in the scope of clinical diagnosis and treatment. Occlusal trauma refers to a disorder in occlusal relationships or a sudden increase in biting force, causing the periodontal tissue to experience pressure beyond normal physiological levels. Its typical manifestations include the presence of early contact points, occlusal interference, and corresponding discomfort. In severe cases, it may even lead to tooth movement or apical fracture [1].

The current basic treatment methods for chronic periodontitis are relatively well-established, mainly including key techniques such as supragingival scaling, subgingival scaling, and root planing. These methods can effectively remove local pathogenic factors such as dental plaque and dental calculus. Approximately 60%-70% of patients with simple chronic periodontitis can achieve symptom relief through the aforementioned treatments. However, for patients with concurrent occlusal trauma, traditional basic treatment methods have significant limitations. On the one hand, the stress imbalance in periodontal tissues caused by occlusal trauma is difficult to fundamentally

reverse through conventional means. Even if dental plaque is successfully removed, the periodontal tissues may fall into a state of dynamic equilibrium imbalance between "repair-destruction". On the other hand, loose teeth and occlusal discomfort can interfere with patients' daily oral hygiene maintenance behaviors, accelerating the process of plaque reattachment and forming a vicious cycle of "treatment-recurrence". Developing specialized intervention strategies for occlusal trauma is one of the important directions to overcome the treatment dilemma of chronic periodontitis. Occlusal adjustment is an important technical means to alleviate occlusal trauma [2]. By precisely correcting abnormal contact points on the occlusal surface of teeth, a stable and coordinated occlusal relationship is formed, improving the mechanical environment of periodontal tissues. In recent years, the widespread use of T-Scan III occlusal analysis systems and digital occlusal recording devices has greatly improved the accuracy of occlusal adjustment. Not only can early contact points be accurately identified and the distribution of occlusal force quantitatively analyzed, but also the treatment effect can be objectively evaluated. Current clinical research mostly focuses on the operational norms of occlusal adjustment, with relatively few studies on the changes in periodontal indicators and efficacy evaluation in patients with chronic periodontitis accompanied by occlusal trauma, and there is a lack of data for comparative analysis with traditional basic treatment modes. Most current clinical observational studies are targeted at small sample groups (usually less than 30 cases) and have short follow-up periods, so the conclusions lack sufficient scientific basis. To overcome this limitation, this study selected 60 patients with chronic periodontitis accompanied by occlusal trauma as experimental subjects, using a randomized controlled trial design to comprehensively evaluate the comprehensive effect of occlusal adjustment combined with conventional periodontal treatment, thus providing credible evidence-based medical evidence for clinical practice [3].

1. Materials and Methods

1.1 General Information

This study selected 60 patients with chronic periodontitis accompanied by occlusal trauma who visited the hospital between January 2023 and January 2024. They were divided into an experimental group (n = 30) and a control group (n = 30) using a random number table. The experimental group included 16 male patients and 14 female patients, with ages ranging from 28 to 62 years, with an average age of (45.32 ± 8.15) years. The duration of the disease ranged from 1 to 5 years, with an average duration of (2.85 ± 0.96) years. The number of affected teeth ranged from 4 to 8, with an average of (5.62 ± 1.23) teeth. In the control group, there were 15 male patients and 15 female patients, with ages ranging from 27 to 63 years, with an average age of (44.86 ± 7.92) years. The duration of the disease ranged from 1 to 6 years, with an average duration of (3.02 ± 1.05) years. The number of affected teeth ranged from 3 to 8, with an average of (5.48 ± 1.17) teeth. Statistical data showed no significant differences between the two groups in terms of gender ratio, age composition, disease duration, and number of affected teeth ($P > 0.05$). Inclusion criteria: (1) According to the diagnostic criteria for chronic periodontitis in Periodontology, the inclusion criteria were: gingival bleeding, periodontal pocket depth ≥4mm, attachment loss ≥2mm, horizontal or vertical resorption of the alveolar bone on X-ray, symptoms of occlusal trauma such as early contact points, occlusal interference, tooth mobility, and pain during mastication, aged between 25 and 65 years, no history of severe cardiovascular, hepatic, or renal diseases, no periodontal treatment within the past 3 months, and no use of antibiotics or immunosuppressants. All participants had signed the informed consent form. Exclusion criteria: (1) Patients with acute periodontitis or oral mucosal diseases; (2) Patients with tooth mobility reaching grade III and no retention value, requiring extraction surgery; (3) Patients with temporomandibular joint disorder syndrome or abnormal occlusion (crossbite, deep overbite), requiring orthodontic treatment; (4) Women in pregnancy or lactation period; (5) Individuals with mental illnesses or cognitive impairments are excluded due to their inability to cooperate with the diagnostic and treatment process as well as subsequent follow-up management [4].

1.2 Method

1.2.1 Conventional Group: Conventional Periodontal Basic Treatment Protocol

(1) Prophylaxis procedure: Use the EMS Woodpecker ultrasonic scaler to remove dental plaque, calculus, and pigment from the crown and gingival sulcus. After the procedure, rinse the gingival surface alternately with 3% hydrogen peroxide solution and saline. Subgingival scaling and root planing: Under local anesthesia, use the Gracey scaler to penetrate deep into the periodontal pocket to thoroughly remove subgingival calculus, bacterial biofilm, and pathological cementum, making the root surface smooth, which is conducive to the recovery of periodontal tissue attachment level. Postoperative care plan: Teach patients the Bass technique for brushing their teeth, and use dental floss or interdental brushes to maintain oral hygiene. Administer metronidazole (0.4g/time, three times a day) and amoxicillin (0.5g/time, three times a day) orally for five consecutive days to reduce the risk

of infection. Schedule follow-up visits on the seventh and fourteenth days after treatment to evaluate the efficacy and adjust subsequent intervention measures.

1.2.2 Experimental Group: Periodontal Basic Treatment Combined with Occlusal Adjustment

The conventional periodontal basic treatment is the same as that in the control group. One week after treatment, occlusion adjustment is performed. The specific steps are as follows: (1) Occlusion assessment: Using GC occlusal color paper, wax sheets, and the T-Scan III digital occlusal analysis system, the distribution of contact points in centric occlusion, lateral occlusion, and protrusive occlusion, as well as the characteristics and sequence of occlusal force, are assessed to precisely identify early contact areas and potential occlusal interference points. Occlusion adjustment plan: Adhering to the "progressive" principle, early contact points of functional cusps (such as the buccal cusp of mandibular posterior teeth and the lingual cusp of maxillary posterior teeth) are addressed first, followed by detailed correction of occlusal interference areas in non-functional cusps, with each bone removal not exceeding 0.5mm. When protrusive occlusion is obstructed, adjustments can be made to the lingual side of maxillary anterior teeth or the cutting edge of mandibular anterior teeth to improve the situation. If there are abnormalities in lateral occlusion, adjustments are made to the bevel of the buccal cusp on the working side or the bevel of the lingual cusp on the non-working side. Postoperative review: The T-Scan III device is used to verify the adjustment effect, ensuring centric occlusion is uniform, lateral and protrusive occlusions are free of interference, and checking for any discomfort felt by the patient. A follow-up visit is conducted one month after surgery, and secondary fine adjustments are performed according to the dynamic changes in occlusion, to strengthen the treatment outcome and maintain long-term stability. Two groups of subjects are selected for a three-month dynamic follow-up observation, during which follow-ups are conducted in stages (the first week, the second week, the first month, and the third month) according to the treatment plan design. By observing the evolution of periodontal-related indicators, the clinical efficacy is comprehensively evaluated and analyzed.

1.3 Observation Indicators

1.3.1 Periodontal Clinical Indicators

Before treatment and three months after the end of the study, the Hu-Friedy brand periodontal probe was used to measure the periodontal probing depth (PD), attachment loss (AL), and gingival bleeding index (GBI) of all teeth in both groups. For each tooth, measurements were taken in four directions: mesial, distal, buccal, and lingual. The average of all measurements was calculated as the final result. (1) PD: The vertical distance from the gingival margin to the bottom of the periodontal pocket. (2) AL: The vertical distance from the cementoenamel junction to the bottom of the periodontal pocket. (3) The GBI scoring system is based on the Löe-Silness gingival bleeding index, with the following classification criteria: 0 for healthy gums, no bleeding; 1 for mild inflammation, no bleeding upon probing; 2 for moderate inflammation, some spotty bleeding after probing; 3 for severe inflammation, significantly increased bleeding upon probing or spontaneous bleeding.

1.3.2 Overall response rate

Three months after the end of treatment, in order to comprehensively evaluate the recovery status of periodontal tissue, scientific quantitative analysis can be conducted according to the evaluation indicators and standard system specified in the "Clinical Periodontology Diagnosis and Treatment Guidelines." (1) Clinical efficacy evaluation shows that after the implementation of intervention measures, gingivitis completely disappeared, the probing depth (PD) decreased by more than 2 millimeters compared to the baseline, the amount of attachment loss (AL) reduced by more than 1 millimeter, and the degree of tooth mobility improved, without adverse reactions such as occlusal discomfort. (2) Excellent clinical efficacy: Gingivitis significantly improved, with an average reduction of 1-2mm in probing depth (PD) and 0.5-1mm in attachment loss (AL); the degree of tooth mobility was controlled, and symptoms of occlusal discomfort were significantly alleviated. (3) Gingivitis continued to develop without signs of relief, with no significant improvement or reduction in probing depth (PD) and attachment loss (AL), no effective control of tooth mobility, and persistent symptoms of occlusal discomfort.

Formula for calculating total effective rate: (number of cases showing significant effect + number of cases showing effective effect) / total number of cases × 100%.

1.4 Statistical Methods

This study utilized SPSS 21.0 software for data processing and statistical analysis. For continuous variables PD, AL, and GBI, descriptive statistics were performed using the mean plus or minus standard deviation ($x \pm s$). Independent sample t-tests were used to determine whether the differences between groups were statistically significant. For categorical variables such as the overall treatment efficacy rate, χ^2 tests were employed to explore

whether there were statistically significant differences in their distribution characteristics. A P value less than 0.05 indicated statistical significance.

2. Results

2.1 Comparative Analysis of Periodontal Indicators Before and After Treatment in Two Patient Groups

The experimental group exhibited a greater reduction compared to the conventional group, with statistically significant differences between groups ($P < 0.05$). Detailed data are presented in Table 1.

Table 1. Comparison of Periodontal Clinical Indicators Before and After Treatment in Two Patient Groups (x±s)

Group	Example count	Periodontal Probing Depth PD (mm)		Attachment Loss AL (mm)		Gingival Bleeding Index GBI (points)	
		Before Care	After Care	Before Care	After Care	Before Care	After Care
Control Group	30	4.85±0.62	3.75±0.91	3.24±0.81	2.38±0.91	3.35±0.21	1.89±0.34
Experimental Group	30	4.92±0.58	2.13±0.42	3.29±0.12	1.53±0.32	3.40±0.18	0.44±0.07
t		0.4516	8.8532	0.3345	4.8264	0.9901	22.8789
P		0.6532	0.0000	0.7392	0.0000	0.3262	0.0000

2.2 Comparison of Overall Response Rates Between Two Patient Groups

Three months after treatment, the overall response rate in the experimental group was higher than that in the conventional group, with a statistically significant difference ($P<0.05$). Specific results are shown in Table 2.

Table 2. Comparison of Overall Response Rates Between Two Patient Groups (n, %)

Group	Number of cases	Significant effect (n)	Effectiveness (n)	Invalid (n)	Total effective (n, %)
Experimental Group	30	18	10	2	28（93.33）
Control Group	30	10	12	8	22（73.33）
χ^2 Value	-	-	-	-	4.320
P Value	-	-	-	-	<0.05

3. Discussion

The interaction mechanism between chronic periodontitis and occlusal trauma is a key research direction in the field of oral medicine. Although occlusal trauma is not a direct cause of periodontitis, it exacerbates the pathological changes of periodontal tissues through multiple pathways: abnormal occlusal force leads to disordered arrangement of periodontal ligament fibers, accelerated resorption of the alveolar bone, and decreased local defense capability; loose or displaced teeth promote plaque deposition, induce gingivitis, and promote the formation of periodontal pockets. In patients with chronic periodontitis who also suffer from occlusal trauma, it is difficult to effectively prevent the continuous damage caused by trauma to periodontal tissues solely relying on traditional periodontal basic treatments (such as scaling), and the clinical outcomes are often poor. Relevant research shows that there is a significant "bidirectional promotion" effect between the two: on the one hand, the degeneration of periodontal supporting structures caused by chronic periodontitis reduces the tolerance threshold of teeth to normal occlusal force, turning originally harmless loads into potential pathogenic factors; on the other hand, occlusal trauma accelerates the resorption of the alveolar bone and interferes with the repair process of periodontal tissues by affecting the blood circulation of the periodontal ligament, disrupting the collagen fiber structure, and inhibiting the activity of fibroblasts [5-6]. Clinical data indicates that patients with chronic periodontitis combined with occlusal trauma have significantly deeper periodontal pockets and greater loss of attachment compared to the control group, and the recurrence rate after conventional treatment reaches 40%, far exceeding the 15% rate in patients with pure chronic periodontitis [7]. This suggests that neglecting the intervention measures of occlusal trauma factors in the comprehensive management of periodontitis cannot effectively prevent disease progression. Relevant research shows that after a 3-month occlusal adjustment intervention, the periodontal pocket depth (PD), attachment loss (AL), and gingival bleeding index (GBI) in the experimental group were superior to those in the control group ($P<0.05$), indicating that this therapy has significant

advantages in improving periodontal tissue inflammation and structural damage. Its mechanism of action mainly manifests in eliminating early contact points and occlusal interference, balancing the distribution of chewing force, reducing the damage caused by local high mechanical stress to the periodontal ligament, thereby preventing inflammation and promoting alveolar bone regeneration; stabilizing the occlusal environment can greatly reduce the risk of tooth loosening and displacement, reduce plaque deposition, and provide good conditions for periodontal health.

Through statistical analysis, it was found that the total effective rate of the experimental group (93.33%) was much higher than that of the control group (73.33%), and the difference between the two was significant ($P<0.05$). This fully reflects the obvious advantages of bite adjustment therapy in improving chronic periodontitis with bite trauma. Research shows that traditional periodontal basic treatment can effectively eliminate pathogenic bacteria, but cannot solve the problem of mechanical imbalance in periodontal tissue caused by bite trauma. bite adjustment improves the bite relationship and provides a more ideal mechanical environment for periodontal tissue, thereby significantly improving clinical efficacy. This method is beneficial for reducing patients' bite discomfort, strengthening their trust and compliance with treatment plans, and promoting the smooth progress of diagnosis and treatment work. Provide strong support [8]. There are certain limitations to this study: the sample size is relatively small (60 cases) and the follow-up time is short (only 3 months), which to some extent restricts the comprehensive investigation of the long-term effects of occlusal adjustment on periodontal health. In terms of core variables, there is no systematic quantitative analysis of important indicators such as adjustment amount and bite force distribution. Subsequent studies need to increase the sample size, increase the tracking time, and further explore the clinical application value and potential mechanism of occlusal improvement strategies by connecting with modern occlusal analysis methods [9]. There are several limitations to this study, and future research can explore them in depth from various aspects. On the one hand, the sample size can be expanded, and a multi center randomized controlled experimental design can be adopted to extend the follow-up time to 1-2 years, in order to systematically examine the long-term efficacy and safety of bite adjustment. On the other hand, advanced detection technologies such as enzyme-linked immunosorbent assay (ELISA) and real-time fluorescence quantitative polymerase chain reaction (qPCR) should be integrated to comprehensively analyze the inflammatory factors (IL-6, TNF - α) in the serum and gingival crevicular fluid of patients before and after treatment By studying the changes in periodontal pathogenic bacteria (such as Actinobacteria and Porphyromonas gingivalis), we aim to understand the specific mechanism of bite adjustment at the molecular level. With the help of digital bite analysis tools, we can accurately quantify the correlation between bite adjustment parameters (such as grinding amount, number of bite contact points, and even distribution of bite force) and the degree of improvement in periodontal indicators. This will provide a scientific basis for developing personalized bite intervention plans. For patients with severe damage to periodontal support tissues, we will plan clinical trials combining bite adjustment with periodontal surgery to explore better comprehensive treatment methods [10].

In summary, incorporating occlusal adjustment techniques into periodontal basic treatment protocols can significantly improve clinical outcomes for patients with chronic periodontitis complicated by occlusal trauma. This approach greatly enhances the effectiveness of comprehensive treatment, demonstrating excellent safety and reliability. It holds considerable practical value and potential for widespread adoption in clinical practice [11].

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