

Analysis of the Impact of Orthodontics Combined with Implant Restoration on Dental Function and Aesthetics in Patients with Dentition Defects and Malocclusions

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Abstract: *Purpose:* To explore the impact of orthodontic combined with implant restoration on the patient's tooth function and aesthetics in patients with dentition defects and malocclusion. *Methods:* From January to December 2023, 68 patients with dentition defects and malocclusion were selected for data analysis in our hospital. They were divided into groups using the random number table method, with 34 patients in each group. The research group used orthodontics combined with implant restoration, and the control group used implant restoration. Compare the data differences between the groups. *Results:* Compared with the control group, the total effective rate of the study group was significantly higher, the chewing efficiency and occlusal force were significantly higher after treatment, the periodontal index was significantly lower after treatment, the aesthetics was significantly higher after treatment, the tooth function score was significantly higher after treatment, and the life quality score was significantly higher after treatment, $p < 0.05$; Comparing the chewing efficiency and occlusal force, periodontal index, aesthetics, tooth function score, and quality of life score before treatment between the two groups, $p > 0.05$. *Conclusion:* The application of orthodontics combined with implant restoration in patients with dentition defects and malocclusion has a great impact on the patient's tooth function and aesthetics, and is significantly improved, which is worthy of clinical application and promotion.

Keywords: Orthodontics; Implant restoration; Dentition defect; Dental malocclusion; Tooth function; Aesthetic effect

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1. Introduction

Common oral complex problems, such as dentition defects and dental malocclusion, analyze the causes of the disease and are related to factors such as trauma, congenital abnormal tooth germ development, bad oral habits, and periodontal disease^[1]. After the disease occurs, the normal arrangement and occlusal relationship of the patient's teeth are destroyed, the chewing function is reduced, and the digestion and absorption of food are affected. The patient's facial aesthetics is reduced due to abnormal tooth shape and position, and problems such as low self-esteem and social anxiety are seriously reduced, and the quality of life is seriously reduced. As people continue to improve their oral health and aesthetic needs,

clinical research is in depth on how to effectively treat patients with this disease. At present, implant restoration is widely used in clinical treatment of patients with dentition defects, which can effectively restore the anatomy of the missing teeth and part of the chewing function. However, for patients with dental malocclusions, if implant restoration is carried out alone, it is difficult to effectively correct problems such as disordered tooth arrangement and abnormal occlusal relationships^[2]. Therefore, clinical methods have been proposed to combine orthodontic treatment, using orthodontic devices to adjust the patient's tooth position and occlusal relationship, which will help the patient to carry out subsequent restorative treatments^[3].

This article selected 68 patients to explore the impact of orthodontic combined with implant restoration on the patient's tooth function and aesthetics in patients with dentition defects and malocclusion.

2. Materials and methods

2.1. Information

In our hospital from January to December 2023, 68 patients with dentition defects and dental malocclusion were selected for data analysis. They were divided into groups using the random number table method, with 34 patients in each group. The study group included 20/14 males and females, aged 22–49 (30.25 ± 3.65) years old, and the control group included 21/13 males and females, aged 21–48 (30.21 ± 3.58) years old. Comparison of the two sets of data resulted in $p > 0.05$.

2.2. Method

In the control group, implant restoration was used. The patient's affected teeth and periodontal examination were performed, and the size, location and number of dentition defects were evaluated.

Impressions were prepared, porcelain crowns were adjusted, trial fitting was performed, and the teeth and jaws were adjusted based on the actual conditions. After no errors were found, the fixation was strengthened.

The research team used orthodontics combined with implant restoration, and used X-rays to take X-rays of the patient's cranium, and observed the absorption of the patient's tooth roots and alveolar bone. They selected a tooth model, determined the treatment plan based on the patient's actual situation, corrected and fixed the affected tooth, and determined the treatment period (6–20 months) based on the patient's actual situation. After the orthodontic treatment was satisfactory, implant restoration was implemented. The method was the same as the control group.

2.3. Observation indicators

- (1) Compare the total effectiveness of the two groups. After treatment, if the patient's teeth are neat and complete, and normal speech and chewing functions are restored, the treatment is judged to be effective; if the patient's teeth are straight and complete, and the speech and chewing functions are improved, the treatment is judged to be effective; in other cases, the treatment is judged to be ineffective. Total efficiency = 100% – inefficiency.
- (2) Compare the chewing efficiency and bite force between the two groups.
- (3) Compare the periodontal index of the two groups.
- (4) Compare the aesthetics of the two groups. Assessed using the Red Aesthetic Index.
- (5) Compare the dental function score of the two groups. Each item is scored from 1 to 4 points, with high scores indicating good dental function.
- (6) Compare the quality-of-life scores of the two groups. Specialized assessment of disease using implant dentures.

2.4. Statistical analysis

Data calculation was completed with statistical SPSS 28.0 software. Measurement data were described with $\bar{x} \pm s$, t test, count data was described with %, χ^2 test, $p < 0.05$, statistically significant.

3. Results

Compared with the control group, the total effective rate of the study group was significantly higher, the chewing efficiency and occlusal force were significantly higher after treatment, the periodontal index was significantly lower after treatment, the aesthetics after treatment was significantly higher, the tooth function score was significantly higher after treatment, and the life quality score was significantly higher after treatment, $p < 0.05$; Comparing the chewing efficiency and bite force, periodontal index, aesthetics, tooth function score, and quality of life score before treatment between the two groups, $p > 0.05$. See **Table 1**, **2**, **3**, **4**, **5** and **6**.

Table 1. Compares the total effective rate (%) of the two groups

Group	Effective	Valid	Invalid	Always efficient
Research group (n = 34)	20 (58.82)	13 (38.24)	1 (2.94)	97.06
Control group (n = 34)	10 (29.41)	16 (47.06)	8 (23.53)	76.47
χ^2				6.2750
p				< 0.05

Table 2. Comparison of chewing efficiency and bite force between the two groups

Group	Chewing efficiency (%)		Bite force (lbs)	
	Before treatment	After treatment	Before treatment	After treatment
Research group (n = 34)	63.95 ± 10.51	94.77 ± 12.37	103.25 ± 7.52	166.47 ± 6.48
Control group (n = 34)	64.01 ± 10.47	72.62 ± 11.05	103.28 ± 7.48	123.46 ± 5.85
t	0.0236	7.7867	0.0165	28.7273
p	> 0.05	< 0.05	> 0.05	< 0.05

Table 3. Comparison of periodontal index between the two groups

Group	PD (mm)		SBI (point)		PLI (point)	
	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Research group (n = 34)	6.95 ± 1.37	3.08 ± 0.32	3.32 ± 0.47	1.33 ± 0.35	2.70 ± 0.17	1.02 ± 0.23
Control group (n = 34)	6.90 ± 1.33	5.26 ± 0.28	3.28 ± 0.52	2.36 ± 0.52	2.72 ± 0.22	1.62 ± 0.17
t	0.1527	29.8949	0.3328	9.5815	0.4194	12.2325
p	> 0.05	< 0.05	> 0.05	< 0.05	> 0.05	< 0.05

Table 4. Comparison of the aesthetics of the two groups (points)

Group	Before treatment	After treatment
Research group (n = 34)	4.08 ± 0.56	10.07 ± 1.28
Control group (n = 34)	4.11 ± 0.65	8.15 ± 0.96
t	0.2039	6.9971
p	> 0.05	< 0.05

Table 5. Comparison of dental function scores (points) between the two groups

Group	Chewing function		Language function		Swallowing function	
	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Research group (n = 34)	23.68 ± 3.14	42.41 ± 3.88	20.38 ± 3.51	39.85 ± 3.99	26.81 ± 3.92	41.61 ± 4.48
Control group (n = 34)	23.71 ± 3.22	33.07 ± 3.54	20.44 ± 3.55	31.07 ± 3.62	26.84 ± 3.96	34.16 ± 4.15
<i>t</i>	0.0389	10.3691	0.0701	9.5028	0.0314	7.1135
<i>p</i>	> 0.05	< 0.05	> 0.05	< 0.05	> 0.05	< 0.05

Table 6. Comparison of quality-of-life scores (points) between the two groups

Group	Functional limitations		Psychology and Social		Physical pain and discomfort	
	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Research group (n = 34)	3.25 ± 0.44	1.06 ± 0.22	3.55 ± 0.71	1.17 ± 0.26	2.66 ± 0.61	0.77 ± 0.32
Control group (n = 34)	3.26 ± 0.45	1.56 ± 0.33	3.47 ± 0.61	1.77 ± 0.36	2.58 ± 0.52	1.44 ± 0.38
<i>t</i>	0.0926	7.3510	0.4983	7.8784	0.5820	7.8640
<i>p</i>	> 0.05	< 0.05	> 0.05	< 0.05	> 0.05	< 0.05

4. Discussion

Dentition defects accompanied by malocclusion are oral composite problems that are of major clinical concern. As people improve their oral health and aesthetic needs, they gradually abandon single treatment options. Although implant restoration can reconstruct the shape and part of the function of the patient's missing teeth, there are certain limitations in clinical application. If simple orthodontic treatment is carried out for the patient, although the patients' occlusal relationship can be improved, but the patient's missing tooth vacancies cannot be filled. The patient needs to wear a removable denture for a long time, which affects the comfort and will lead to accelerated alveolar bone absorption. In response to this situation, a combined treatment model is proposed clinically^[4]. First, orthodontic correction is used for the patient, and then implant restoration is carried out for the patient, which can effectively solve the patient's clinical pain points. This article verifies the high application value of this combined treatment model through comparative data analysis.

Judging from the clinical research results, after combined treatment for patients, the patient's prognosis has been significantly improved, and all core indicators are significantly better than single implant restoration. In terms of the total effective rate of treatment, 97.06% of the research group far exceeded that of the control group ($p < 0.05$). This is because orthodontic treatment was first carried out for the patient, and through the use of archwires, brackets and other appliances, the patient's tooth position was effectively adjusted and the dentition was aligned. To coordinate the patient's occlusal relationship, during the subsequent implant restoration process, the implant is accurately implanted in the optimal stress-bearing area of the alveolar bone, which can effectively avoid patients' uneven stress or implant tilt due to abnormal dentition, and the overall treatment effect is significantly improved^[5]. In terms of functional indicators, after treatment, the chewing efficiency ($94.77 \pm 12.37\%$) and bite force (166.47 ± 6.48) lbs of the study group were significantly improved compared to the control group ($p < 0.05$). The reason is that orthodontic correction can help patients form a normal overbite relationship between the upper and lower jaws, and the implants and natural teeth are evenly contacted and occupied, and

trauma and efficiency loss are significantly reduced. In terms of periodontal health maintenance, the periodontal index of the study group after treatment (PD: 3.08 ± 0.32 mm, SBI: 1.33 ± 0.35 points, PLI: 1.02 ± 0.23 points) was significantly lower than that of the control group ($p < 0.05$). The reason was analyzed because the patients had teeth crowding, torsion, etc. In this situation, there are cleaning dead corners, which can easily accumulate plaque and cause inflammation. After orthodontic treatment for the patient and aligning the teeth, it is easier to carry out corresponding cleaning operations, and plaque adhesion is reduced^[6]. Orthodontic treatment for the patient and appropriate traction of the periodontal tissue can promote gingival keratinization, repair alveolar bone, and enhance periodontal resistance. In terms of aesthetics and quality of life, the red aesthetic index of the study group (10.07 ± 1.28 points) after treatment was significantly higher than that of the control group ($p < 0.05$), and the dental function scores (Chewing, language, and swallowing functions were 42.41 ± 3.88 points, 39.85 ± 3.99 points, and 41.61 ± 4.48 points respectively) were improved compared with the control group ($p < 0.05$), and the scores of each dimension of quality of life (functional limitation 1.06 ± 0.22 points, psychological and social 1.17 ± 0.26 points, physical pain and discomfort 0.77 ± 0.32 points) were significantly lower than the control group ($p < 0.05$). The above data fully reflects the effect of combined treatment, which can significantly improve the patient's physical and mental status. Orthodontics can align teeth^[7]. There is a high degree of coordination between dental implants and natural teeth in various directions. The patient's face Problems such as facial asymmetry have been effectively improved, and chewing and language functions have been restored. After joint treatment for patients, pronunciation and eating difficulties are significantly reduced, and aesthetics are improved. The patient's social anxiety can be effectively alleviated, and the patient's quality of life is ultimately significantly improved^[8].

An in-depth analysis of the mechanism of the advantages of combined treatment includes three aspects: at the anatomical level, the application of orthodontic treatment can achieve a balance between bone resorption and bone formation through physiological reconstruction of the alveolar bone, providing sufficient space and bone volume for patients with implantation. If the patient has crowded teeth and missing teeth, the width of the alveolar bone in the patient's edentulous area can be effectively expanded, the patient's surgical risk is reduced, the tilted adjacent teeth can be straightened, and the interproximal relationship in the edentulous area can be effectively restored, which can effectively reduce food impaction. At the biomechanical level, joint treatment is carried out for patients. The implant is in a "physiological occlusal force" state, and the occlusal force is evenly transmitted along the implant-bone interface, which can effectively promote osseointegration. At the clinical logic level, the patient is first treated with orthodontic treatment, and then implant restoration is carried out for the patient. The principle followed is to first correct the basic problem, and then carry out corresponding repair. If the reverse is done, the patient may suffer from implant displacement and osseointegration damage.

To sum up, for patients with dentition defects and malocclusion, in order to effectively improve the treatment efficiency and improve the patient's dental function, it is necessary to carry out orthodontic combined with implant restoration, which can play a synergistic effect, "correcting the occlusal foundation + repairing functional defects". After the patient's treatment, the risk of periodontal inflammation is obvious. The oral cavity is significantly reduced, and the aesthetics and quality of life are effectively improved. Analysis of this combined treatment model is consistent with modern oral medicine's "paying equal attention to function and aesthetics, and taking into account both short-term and long-term". It can provide scientific solutions for the future clinical treatment of patients with such complex oral problems, and has high clinical application and promotion value.

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Disclosure statement

The author declares no conflict of interest.

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