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ABOUT COVER

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Retrospective Study

Comparison of dental pulp periodontal therapy and conventional simple periodontal therapy as treatment modalities for severe periodontitis

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Abstract

BACKGROUND

Severe periodontitis is a major oral health concern today as it can lead to loss of teeth. Conventional periodontal therapy has numerous pitfalls as it does not address the pulp-periodontal complex in its entirety.

AIM

To investigate the effect of dental pulp periodontal therapy on the levels of interleukin-1 β (IL-1 β) and IL-10 in gingival crevicular fluid (GCF) in patients with severe periodontitis.

METHODS

Eighty-six patients with severe periodontitis were randomly divided into a research group ($n = 43$) and a control group ($n = 43$). The control group was treated with simple periodontal therapy, and the research group was treated with dental pulp periodontal therapy. The total effective rates of the treatments; periodontal status before and after treatment through the measurement of the periodontal pocket probing depth (PPD), gingival sulcus bleeding index (SBI), mobility (MD), and plaque index (PLI); the levels of inflammatory factors IL-1 β and IL-10 in the GCF; and the incidence of complications were calculated for both groups and compared using the Student's t test and the χ^2 test.

RESULTS

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The total effective rate of treatment in the study group (93.02%) was higher than that in the control group (76.74%; $P < 0.05$). While before treatment, there was no significant difference in the PLI, MD, SBI, or PPD between the two groups, the post-treatment values of PLI, MD, SBI, and PPD (4.71 ± 0.16 mm, 0.61 ± 0.09 mm, 0.96 ± 0.17 mm, and 0.76 ± 0.26 mm, respectively) were significantly lower ($P < 0.05$) in the research group than in the control group (5.35 ± 0.24 mm, 0.93 ± 0.15 mm, 1.35 ± 0.30 mm, and 1.04 ± 0.41 mm, respectively). There was no significant difference in the level of IL-1 β or IL-10 in the GCF before treatment between the two groups; after treatment, the IL-1 β level in the research group (139.04 ± 15.54 pg/mL) was significantly lower than that in the control group (156.35 ± 18.10 pg/mL), and the level of IL-10 in the research group (7.98 ± 1.01 ug/L) was higher than that in the control group (5.56 ± 0.96 ug/L) ($P < 0.05$). The incidence of complications in the study group (4.65%) was significantly lower than that of the control group (18.60%; $P < 0.05$).

CONCLUSION

Endodontic therapy and periodontal treatment for patients with severe periodontitis can effectively reduce the levels of inflammatory factors in the GCF and the inflammatory reaction. In addition, it can improve the periodontal condition and the overall treatment effect, reduce the risk of complications, and ensure the safety of treatment.

Key Words: Severe periodontitis; Dental pulp and periodontal therapy; Interleukin-1 β ; Interleukin-10

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Core Tip: Dental pulp periodontal therapy can effectively avoid the shortcomings of simple periodontal therapy. In this study, the authors investigated the efficacy and safety of this treatment.

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INTRODUCTION

Periodontitis is an inflammatory disease of the supporting tissues of the teeth caused by microorganisms, resulting in the progressive destruction of the periodontal ligament and alveolar bone with periodontal pocket formation, gingival recession, or both. The incidence of periodontitis has continued to rise in recent years due to poor oral hygiene habits. It impacts oral health and quality of life and is an important cause of tooth loss in adults[1,2]. Severe periodontitis can not only affect periodontal tissues but also the dental pulp. Infection of the pulp can in turn adversely affect periodontal tissue healing[3,4].

At present, most patients with severe periodontitis are managed with simple periodontal therapy. While it can improve periodontal condition to an extent, it may result in damage to the gingiva. Additionally, the risk of pulpal infection exists because of the relationship between the pulp and periodontium. As a result, its clinical application is limited[5,6]. Dental pulp periodontal therapy can effectively avoid these shortcomings as it involves treatment of both dental pulp and periodontal lesions. Furthermore, it can reduce the re-occurrence of infection, and ensure the effectiveness and safety of treatment[7,8].

The present study aimed to evaluate the effectiveness of dental pulp periodontal therapy in comparison to simple periodontal therapy for the treatment of severe periodontitis. We compared the total effective rate of treatment; periodontal status indices, such as periodontal probing depth (PPD), gingival sulcus bleeding index (SBI),

tooth mobility (MD), and plaque index (PLI); the levels of interleukin-1 β (IL-1 β) and IL-10 in the gingival crevicular fluid (GCF); and the incidence of complications between the two treatment groups.

MATERIALS AND METHODS

Patient selection criteria

Patients who presented with severe periodontitis to our hospital from March 2019 to March 2020 were selected. The inclusion criteria were: A diagnosis of periodontitis[9], alveolar bone loss involving more than 2/3 of the root length without root tip exposure, tooth mobility less than grade III, knowledge about and consent for participation in this study, good compliance and communication skills, and no history of antimicrobial use in the month before the patient's inclusion in the study. We excluded patients presenting with pulpal disease, acute or severe infections, an immunocompromised status, neurological diseases, and communication disorders; pregnant or lactating female patients; and those who underwent periodontal therapy in the year preceding the commencement of this study.

Patient data

A total of 86 patients were selected and randomly divided into a research group ($n = 43$) and a control group ($n = 43$). The research group comprised 24 men and 19 women in the age range of 34-56 years (mean $\pm$ SD: 44.91 $\pm$ 8.92 years), and the course of disease ranged from 1.1 to 3.9 years (mean $\pm$ SD: 2.51 $\pm$ 1.13 years). The control group comprised 26 men and 17 women in the age range of 32-59 years (mean $\pm$ SD: 46.04 $\pm$ 9.33 years), and the course of disease was 0.9-4.3 years (mean $\pm$ SD: 2.64 $\pm$ 1.08 years). The clinical data such as sex, age, and course of disease were balanced and comparable between the two groups ($P > 0.05$).

Methods

All patients of both groups received basic interventional measures, such as occlusal adjustments, splinting of mobile teeth, antimicrobial therapy, *etc.*, on the basis of different treatment schemes that were adopted. The patients of the control group were treated with simple periodontal therapy, including supragingival scaling, root planing, subgingival curettage, and local administration of minocycline ointment into the periodontal pocket. The research group received endodontic treatment in the teeth exhibiting periodontitis. After local anesthesia administration, an access cavity was prepared, and the pulp was extirpated. Working length determination was done with an apex locator, biomechanical preparation with adequate irrigation using 17% ethylenediaminetetraacetic acid and 2.5% sodium hypochlorite solutions, air-drying treatment, and calcium hydroxide plugging of the root canal. Finally, the canal was obturated using gutta-percha and a root canal sealer after 7 d.

Observation indexes

The outcomes of the two interventions were measured in the following manner: (1) The treatment was considered significantly effective if occlusal function recovered markedly, the alveolar bone loss did not progress, and the clinical symptoms disappeared completely 12 mo after treatment. If the occlusal function recovered to some extent and the clinical symptoms improved but did not disappear completely, the treatment was considered effective. If there was no improvement in occlusal function or clinical symptoms, the treatment was regarded ineffective. The total effective rate was calculated as the percentage of significantly effective and effective outcomes[10]; (2) The periodontal status of the two groups was assessed before and after treatment, including PLI, MD, gingival SBI, periodontal PPD; (3) The levels of inflammatory factors IL-1 β and IL-10 in the GCF were measured before and after treatment. A filter paper strip was cut into a rectangle (10 mm $\times$ 2 mm) and loaded into a microcentrifuge tube (0.5 mL). Plaque and calculus deposits coronal to the observation point were removed. The patient was asked to gargle with water for 10 min and then the gingival sulcus was dried. The filter paper strip was inserted with tweezers into the mesial, central, and distal gingival sulci, and discontinued after resistance. After 30 s, 200 μ L of buffer was added to the microcentrifuge to shake for 60 min. The filter paper was removed, frozen in the refrigerator at -70 $^{\circ}$ C, and subjected to an enzyme-linked immunosorbent assay; and (4) The incidence of complications in the two groups was calculated.

Statistical analysis

All continuous data are presented as the mean $\pm$ SD and analyzed using the Student's *t* test. The count data were analyzed using the χ^2 test. All data were analyzed using the SPSS v22.0 software. A *P* value of < 0.05 indicated a significant difference.

RESULTS

Therapeutic effects

The total effective rate of the study group (93.02%) was higher than that of the control group (76.74%; *P* < 0.05) (Table 1).

Periodontal status

Before treatment, there was no significant difference in the observed values of PLI, MD, SBI, and PPD between the research group and the control group. After treatment, the observed values of PLI, MD, SBI, and PPD in the research group were significantly lower than those of the control group (*P* < 0.05) (Table 2).

Inflammatory factors in GCF

Before treatment, there was no significant difference in the level of IL-1 β or IL-10 in the GCF between the study group (212.59 ± 19.45 pg/mL and 2.83 ± 0.69 ug/L, respectively) and the control group (209.01 ± 22.31 pg/mL and 2.77 ± 0.72 ug/L, respectively). After treatment, the level of IL-1 β in the GCF in the study group (139.04 ± 15.54 pg/mL) was significantly lower than that of the control group (156.35 ± 18.10 pg/mL). The level of IL-10 (7.98 ± 1.01 ug/L) was significantly higher than that of the control group (5.56 ± 0.96 ug/L) (*P* < 0.05) (Table 3).

Incidence of complications

The incidence of complications in the study group (4.65%) was significantly lower than that of the control group (18.60%; *P* < 0.05) (Table 4).

DISCUSSION

Periodontitis is a chronic inflammatory disease of the periodontium mainly caused by microorganisms in plaque. Severe periodontitis is a complex condition that is difficult to treat[11,12]. It can lead to increased tooth mobility and pathologic migration, which may adversely affect masticatory function and esthetics[13,14]. The ideal treatment for severe periodontitis remains a topic of research.

The main treatment modality for severe periodontitis is simple periodontal treatment at present. It is necessary to detect dental pulp vitality before treatment to determine whether dental pulp treatment is necessary or for patients with obvious pulpitis. However, the affected teeth still experience reactions when periodontal inflammation or even local necrosis occurs; therefore, simple periodontal therapy has obvious limitations[15]. In recent years, it has been found that the risk of dental pulp disease is significantly increased if alveolar bone loss involves two-thirds of the root surface. It has been found that periodontal therapy for such patients can easily trigger or aggravate dental pulp disease, which can in turn adversely affect the normal repair of the periodontal tissue[16,17]. The pulp-periodontal complex has great healing potential, and the implementation of systematic pulp periodontal therapy can effectively promote periodontal tissue healing and control inflammatory reactions. Frencken *et al*[18] showed that in patients with severe periodontitis, dental pulp periodontal therapy can effectively improve the SBI and PLI, reduce the depth of the periodontal pockets, and improve the overall treatment effect (91.89%). Kruk *et al*[19] demonstrated that in cases of severe periodontitis treated with dental pulp periodontal therapy, indices such as the PLI and MD improved, and the total effective rate was higher than in cases treated with simple periodontal therapy. In the current study, we observed that the periodontal status-related indices of the research group significantly improved compared to those of the control group, and the total effective rate (93.02%) was higher in the research group than in the control group (76.74%; *P* < 0.05). This finding is consistent with the results of previous studies, which confirms that dental pulp periodontal therapy is more valuable in patients with severe periodontitis and can effectively improve the periodontal condition of patients and the overall treatment effect. The main reason is that although periodontal therapy alone can remove

Table 1 Comparison of therapeutic effects between the two groups, *n* (%)

Group	<i>n</i>	Significantly effective	Effective	Ineffective	Total efficiency
Research	43	26 (60.47)	14 (32.56)	3 (6.98)	40 (93.02)
Control	43	17 (39.53)	16 (37.21)	10 (23.26)	33 (76.74)
χ^2					4.441
<i>P</i> value					0.035

Table 2 Comparison of periodontal status between the two groups before and after treatment (mean $\pm$ SD)

Group	<i>n</i>	PLI	MD (mm)	SBI	PPD (mm)
Before treatment					
Research	42	7.88 $\pm$ 0.68	3.39 $\pm$ 0.39	6.45 $\pm$ 0.65	5.39 $\pm$ 0.63
Control	42	8.01 $\pm$ 0.73	3.45 $\pm$ 0.37	6.68 $\pm$ 0.61	5.54 $\pm$ 0.70
<i>t</i>		0.951	0.797	1.843	1.137
<i>P</i> value		0.344	0.427	0.068	0.258
After treatment					
Research	42	4.71 $\pm$ 0.16	0.61 $\pm$ 0.09	0.96 $\pm$ 0.17	0.76 $\pm$ 0.26
Control	42	5.35 $\pm$ 0.24	0.93 $\pm$ 0.15	1.35 $\pm$ 0.30	1.04 $\pm$ 0.41
<i>t</i>		15.845	13.064	8.077	4.119
<i>P</i> value		0.000	0.000	0.000	0.000

PLI: Plaque index; MD: Mobility; SBI: Sulcus bleeding index; PPD: Pocket probing depth.

Table 3 Comparison of inflammatory factors in gingival crevicular fluid between the two groups before and after treatment (mean $\pm$ SD)

Group	<i>n</i>	IL-1 β (pg/mL)	IL-10 (ug/L)
Before treatment			
Research	42	212.59 $\pm$ 19.45	2.83 $\pm$ 0.69
Control	42	209.01 $\pm$ 22.31	2.77 $\pm$ 0.72
<i>t</i>		0.864	0.430
<i>P</i> value		0.390	0.668
After treatment			
Research	42	139.04 $\pm$ 15.54	7.98 $\pm$ 1.01
Control	42	156.35 $\pm$ 18.10	5.56 $\pm$ 0.96
<i>t</i>		5.182	12.403
<i>P</i> value		0.000	0.000

IL: Interleukin.

subgingival necrotic tissue, calculus, and plaque on the tooth surface, it is effectively a mechanical treatment. It can potentially affect periodontal tissue healing and may lead to infection after treatment. Further, dental pulp periodontal therapy can more effectively improve the healing of the periodontium, reduce pulp inflammation, and avoid pulp infection in the process of treatment. In addition, it can achieve a radical cure, eradicate existing pulpal infection, and establish a coordinated relationship to promote periodontal tissue healing and improve tooth mobility. Moreover, the injection of minocycline hydrochloride through the root canal approach can not only achieve the efficacy of traditional drugs for root canal disinfection but also peri-root

Table 4 Comparison of the incidence of complications between the two groups, *n* (%)

Group	<i>n</i>	Poor healing	Periodontal infection	Dental pulp infection	Total incidence rate
Research	43	1 (2.33)	1 (2.33)	0 (0.00)	2 (4.65)
Control	43	3 (6.98)	2 (4.65)	3 (6.98)	8 (18.60)
χ^2					4.074
<i>P</i> value					0.044

and apical effects through the potential pathogenetic trafficking pathway in dental pulp and periodontal lesions and thus improve the therapeutic effect.

GCF, an exudate in the gingival sulcus, can accurately reflect the metabolic changes in the periodontium and thus, the degree of periodontitis. The evaluation of periodontitis by measuring the classic inflammatory factors in the GCF is non-invasive, convenient, and repeatable. IL-1 β promotes the proliferation of T and B lymphocytes, induces host inflammatory response, and promotes the destruction of bone and cartilage[20]. IL-10 is a multifunctional cytokine, mainly secreted by Th1 cells, which can participate in the immune response and inflammatory reactions, and has antiallergic and anti-inflammatory effects; it also inhibits eosinophils and accelerates their apoptosis. IL-10 levels have been reported to continuously decrease with increasing periodontal loss[21]. In the present study, the level of IL-1 β in the GCF in the research group was lower than that of the control group, and the level of IL-10 in the research group was higher than that of the control group ($P < 0.05$). Serum microscopic analysis further confirmed that the effect of dental pulp periodontal treatment is better, which can improve oral inflammation and periodontal condition. In addition, this study also found that the incidence of complications in the study group (4.65%) was lower than that of the control group (18.60%; $P < 0.05$). This result indicated that dental pulp periodontal therapy can also reduce the risk of complications in patients with severe periodontitis.

CONCLUSION

In conclusion, dental pulp periodontal treatment for patients with severe periodontitis can effectively reduce the levels of inflammatory factors in the GCF and reduce inflammatory reactions. In addition, dental pulp periodontal treatment can improve periodontal condition and the overall treatment effect, and reduce the risk of complications to ensure the safety of treatment.

ARTICLE HIGHLIGHTS

Research background

Periodontitis is an inflammatory disease of the supporting tissues of the teeth caused by microorganisms, resulting in the progressive destruction of the periodontal ligament.

Research motivation

Periodontitis impacts oral health and quality of life and is an important cause of tooth loss in adults.

Research objectives

We wanted to evaluate the effectiveness of dental pulp periodontal therapy in comparison to simple periodontal therapy for the treatment of severe periodontitis.

Research methods

We selected patients with severe periodontitis at our hospital who met the inclusion and exclusion criteria.

Research results

After treatment, the interleukin-1 β (IL-1 β) level of the study group was significantly

lower than that of the control group, and the IL-10 level was significantly higher than that of the control group.

Research conclusions

Dental pulp periodontal treatment can improve periodontal condition and the overall treatment effect, and reduce the risk of complications to ensure the safety of treatment.

Research perspectives

The level of inflammatory factors reflects the prognosis of periodontitis treatment.

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