

Efficacy of combined orthodontic-periodontic treatment for patients with periodontitis and its effect on inflammatory cytokines: A comparative study

Jin Zhang, Ai-Min Zhang, Zong-Mei Zhang, Jin-Lin Jia, Xin-Xin Sui, Lu-Rui Yu, and Hai-Tao Liu
Dongying, China

Introduction: In this study, we aimed to investigate the efficacy of combined orthodontic-periodontic treatment in the treatment of patients with periodontitis and its effects on the levels of inflammatory cytokines. **Methods:** A total of 117 patients with periodontitis were randomly assigned to the basic group (receiving basic periodontic treatment, $n = 58$) and the combined group (receiving combined orthodontic-periodontic treatment, $n = 59$). In addition, 52 healthy people without periodontal disease were selected as the normal group. Probing depth, tooth mobility, plaque index, clinical attachment level, and sulcus bleeding index were recorded. ELISA was applied to detect gingival crevicular fluid (GCF) and serum levels of inflammatory cytokines. A 2-year clinical follow-up was conducted. **Results:** Before treatment, the periodontal parameters (probing depth, tooth mobility, plaque index, clinical attachment level, and sulcus bleeding index) and GCF and serum levels of inflammatory cytokines (high-sensitivity C-reactive protein, interleukin-1 β , interleukin-5, interleukin-6, interleukin-8, tumor necrosis factor- α , and prostaglandin E2) in the combined and basic groups were higher than those in the normal group. After 6 and 18 months of treatment, the periodontal parameters and GCF and serum levels of inflammatory cytokines decreased in the combined and basic groups. The periodontal parameters and the GCF and serum levels of inflammatory cytokines in the combined group were significantly lower than those in the basic group after 18 months of treatment. The combined group had a lower recurrence rate compared with the basic group. **Conclusions:** Combined orthodontic-periodontic treatment had good clinical efficacy in the treatment of periodontitis and could effectively decrease the levels of inflammatory cytokines. (Am J Orthod Dentofacial Orthop 2017;152:494-500)

Periodontitis is an infectious inflammatory disease of tooth-supporting tissues with high morbidity and alternative occurrence of remission and acute exacerbation.¹ There are 2 main causes of periodontitis. One is the sedimentation of dental plaque bacteria, intercellular substances, exfoliated epithelial cells, and food debris deposited on the tooth surfaces, and the other is a deficiency of vitamins and minerals or an

abnormality of the immune reaction caused by systemic disease.²⁻⁵ Periodontitis occurs with the intrusion of microorganisms in the periodontal pocket to the blood system through the damaged epithelium. The humoral immunity and cellular immunity activate the mononuclear macrophages and release a number of inflammatory cytokines, such as high-sensitivity C-reactive protein, interleukin-1 β , interleukin-5, interleukin-6, interleukin-8, tumor necrosis factor- α , and prostaglandin E2.¹ Overexpressions of inflammatory cytokines can worsen the periodontal inflammation, which is closely related to the development and progression of periodontal diseases.

The diagnosis of periodontitis is based on routine examinations of visual inspection, probing diagnosis and occlusal therapy, and bacterial plaque microbiologic examination, and gingival crevicular fluid (GCF) factor inspection can also reflect the occurrence of

From the Department of Stomatology, Dongying People's Hospital, Dongying, China.

All authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest, and none were reported.

Address correspondence to: Jin Zhang, Department of Stomatology, Dongying People's Hospital, No. 317, Nanyi Road, Dongying District, Dongying 257091, Shandong Province, P.R. China; e-mail, zhangjin2105@163.com.

Submitted, January 2016; revised and accepted, January 2017.

0889-5406/\$36.00

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<http://dx.doi.org/10.1016/j.ajodo.2017.01.028>

periodontitis.¹ Clinical treatments of periodontitis have gradually diversified into drug treatment, orthodontic treatment, and periodontic treatment. Periodontic treatment includes the removal of bacterial plaque and treatment of the traumatic occlusion, which can effectively improve the patient's gingival bleeding, periodontal abscess, and other periodontal symptoms.⁶⁻⁸ Orthodontic treatment can suppress pathologic tooth migration, control bacterial plaque, and establish a good occlusion to promote the restoration of the periodontal tissues.⁹⁻¹¹ We aimed to compare the efficacy of the combined orthodontic-periodontic treatment and basic periodontic treatment for patients with periodontitis and to investigate the effects of combined orthodontic-periodontic treatment on levels of inflammatory cytokines.

MATERIALS AND METHODS

This study was performed with the approval of the ethnic committee of Dongyang People's Hospital, Dongyang, China. Informed consent was obtained from all subjects.

Between January 2011 and January 2013, a total of 117 patients with periodontitis were selected from our hospital. They included 67 men and 50 women, with a mean age of 35.7 ± 5.9 years (range, 22-46 years). There were 59 patients with pathologic tooth migration characterized by tooth elongation, tooth displacement, gingival bleeding, and loose teeth. The disease course of patients (from gingival bleeding and swelling to periodontal pocket formation, periodontal abscess, and loose teeth) was 12.5 ± 3.5 months (range, 6-18 months). According to the clinical attachment level of periodontitis, the patients were classified into 3 categories: mild (1-2 mm, $n = 48$), moderate (3-4 mm, $n = 39$), and severe (≥ 5 mm, $n = 30$).¹² These 117 patients were randomly assigned to the basic group (receiving basic periodontic treatment, $n = 58$) and the combined group (receiving combined orthodontic-periodontic treatment, $n = 59$). The combined treatment group included all patients with pathologic tooth migration (38 men, 21 women; mean age, 36.5 ± 5.8 years) who received orthodontic treatment. The basic treatment group contained all patients without pathologic tooth migration (30 men 28 women; mean age, 34.8 ± 6.1 years). The general information of the patients in the 2 groups was not significantly different ($P > 0.05$), suggesting comparability. Inclusion criteria were the following: (1) all patients met the diagnostic criteria of periodontitis, with no more than 2 missing teeth¹³; (2) they did not receive periodontal treatment within at least 3 months and did not take any antibiotics or nonsteroidal anti-inflammatory drugs

within 1 month; and (3) they did not use a mouthwash that contained antibacterial, antimicrobial, and anti-inflammatory drugs. Exclusion criteria were the following: (1) patients with poor compliance; (2) patients with systemic diseases, such as coronary heart disease, diabetes, chronic nephritis, and so on; (3) patients with severe mental disorders; (4) patients with severe liver and kidney dysfunctions; and (5) women in the gestation or lactation period, or with intended pregnancy during the treatment. In addition, 52 healthy people (29 men, 23 women; mean age, 36.8 ± 6.7 years) without periodontal disease were selected as the normal group. All subjects received primary prevention and regular scaling and were educated about the correct method of brushing teeth.¹⁴ These healthy people were matched with the patients in the combined and basic groups for sex and age.

Patients in the basic group were given basic periodontic treatment to remove local risk factors. The relevant knowledge of periodontal diseases, dos and don'ts in orthodontic treatment, precautionary measures, and the importance of oral hygiene were all introduced to the patients. The basic periodontic treatment was implemented to completely eliminate periodontal pathogenic factors. Their periodontal health was monitored, and regular tooth maintenance, supragingival scaling, subgingival scaling, and root planing were performed within 6 months. After basic periodontic treatment, periodontal flap surgery was further applied for patients with deep periodontal pockets caused by severe bone loss to completely eliminate the damaged periodontal tissue. The periodontal situation was reexamined after 3 months of treatment. Patients in the combined group continued to receive orthodontic-surgical treatment after the basic periodontic treatment. Functional and fixed appliances were used to maintain the elimination of occlusal trauma, relieve tooth crowding, and recover the esthetics and function of the teeth. Three months after the basic periodontic treatment, the periodontal situation was reexamined. The localized periodontal inflammation disappeared, and the alveolar bone resorption was static in the panoramic x-ray radiographs (dental panoramic x-ray machine; Weifang Newweek Medical Image Equipment, Weifang, Shandong, China).¹⁵ The morphologic features of the teeth of the orthodontic patients were observed with the assistance of cone-beam computed tomography (Changzhou Golden Dental Instrument & Medical, Changzhou, Jiang, China). Straight-wire appliances (Hangzhou ORJ Medical Instrument & Material, Hangzhou, China) were used with light forces to minimize periodontal tissue injuries. A reexamination of the periodontal parameters (probing depth, tooth mobility, plaque index, clinical attachment level, and sulcus

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