

## Original Article

# The curative effect of ultrasonic subgingival curettage combined with Xipayi gingival rinse on patients with chronic periodontitis

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**Abstract:** Objectives: We explored and analyzed the effect and masticatory function of ultrasonic subgingival curettage combined with rinsing and gargling of Xipayi gingival rinse on patients with moderate to severe chronic periodontitis. Methods: We selected 98 patients with moderate to severe chronic periodontitis admitted to our hospital, and randomly divided them into observation group and control group (n=49 in each group). The control group was treated with ultrasonic subgingival curettage. The observation group received ultrasonic subgingival curettage with Xipayi gingival rinse, and continued to use Xipayi gingival rinse for 4 weeks. The changes of periodontal index, inflammatory degree of gingival crevicular fluid, occlusal and masticatory efficiency before and after treatment were compared. Results: The periodontal indexes and the degree of inflammatory factors in gingival crevicular fluid of the two groups post-treatment decreased critically than those of pre-treatment ( $P<0.05$ ), and the periodontal index and the degree of inflammatory factors in gingival crevicular fluid of the observation group was remarkably lower than those of the control group ( $P<0.05$ ). The occlusal time and the balance of occlusal force of the two groups decreased significantly post-treatment compared with those of pre-treatment ( $P<0.05$ ), and the indexes in observation group were dramatically lower than those in control group ( $P<0.05$ ). The standard deviation of masticatory efficiency in the two groups decreased remarkably post-treatment than that of pre-treatment ( $P<0.05$ ), and the index in observation group was obviously lower than that in control group ( $P<0.05$ ). Conclusion: The combined therapy of ultrasonic subgingival curettage and Xipayi gingival rinse can effectively cure moderate to severe chronic periodontitis. Through this treatment, patients can improve periodontal condition and inhibit periodontal inflammation. Meanwhile, patients can improve the stability of occlusion and increase the bite force, thus improving the chewing efficiency. Therefore, the application of this method is worthy of clinical application.

**Keywords:** Ultrasonic subgingival curettage, Xipayi gingival rinse, medium to severe chronic periodontitis, clinical efficacy, masticatory efficiency

## Introduction

Chronic periodontitis is a chronic oral infection that commonly occurs clinically. The infection of periodontal support tissue caused by microorganisms in dental plaque is the ultimate source of disease. Common clinical manifestations of the disease include the formation of periodontal pockets, gingivitis, and even the tooth loss [1, 2]. According to scholars' reports [3, 4], about 95% patients with periodontitis in China have chronic periodontitis, and the chronic periodontitis is the major cause of tooth

loss in Chinese adults. Besides, the disease imposes a serious impact on life quality of patients due to the long course. Basic periodontal treatment, as a common method for chronic periodontitis, includes subgingival curettage and cleaning and other mechanical treatments. The purpose of treatments is to effectively reduce the inflammatory reaction by removing pathogenic bacteria attached to periodontal tissues [5, 6]. As a tea polyphenol drug, Xipayi gingival rinse has significant antibacterial, antiviral, and antioxidant effects, and has been widely adopted in treatment of oral ulcers and gingi-

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vitis [7]. In this study, we explored and analyzed the effect and masticatory function of ultrasonic subgingival curettage combined with rinsing and gargling of Xipayi gingival rinse on patients with moderate to severe chronic periodontitis.

## Materials and methods

### *Clinical material*

98 patients with moderate to severe chronic periodontitis admitted to our hospital from March 2018 to December 2019 were selected, and randomly divided into observation group and control group averagely (n=49 in each group). The study received the approval of the hospital ethics committee.

### *Inclusive criteria and exclusive criteria*

Inclusive criteria: (1) The patients met the diagnostic criteria of moderate to severe periodontitis (Chinese Dental Association) [8]; (2) Patients aged between 25-60 years; (3) The remaining teeth of patients were no less than 20; (4) The patients had not received any periodontal treatment during the past year; (5) No antibiotics or NSAIDs were used in the past 2 months; (6) Patients had voluntarily signed the informed consents.

Exclusive criteria: (1) Patients with abnormal coagulation; (2) Patients with severe cardiovascular, cerebrovascular, liver or kidney diseases; (3) Patients with immune system diseases; (4) Patients who were allergic to the drug used in this study; (5) Women during pregnancy or breastfeeding; or (6) Patients with mental retardation or disorders.

### *Diagnostic criteria of moderate to severe periodontitis*

Moderate periodontitis: the number of teeth with attachment loss  $\geq 4$  mm at the adjacent site of different teeth was  $\geq 2$ . Severe periodontitis: the number of teeth with attachment loss  $\geq 6$  mm at the adjacent site of different teeth  $\geq 2$ , and the number of periodontal pockets  $\geq 5$  mm in the adjacent site of teeth was  $\geq 1$ .

### *Methods*

All patients underwent ultrasonic supragingival cleansing, subgingival curettage, and root planning. The equipment applied during periodontal

treatment was periodontal painless instrument (Guilin Woodpecker Medical Equipment Co., Ltd.). The control-group-patients were rinsed with sterile distilled water during ultrasonic subgingival curettage, and treated with compound borax gargle (Shanghai Haijia Huangpu Pharmaceutical Co., Ltd., H31022772). The patients diluted 10 ml compound borax gargle with 5 times of warm water for 5 min, 3-4 times/d, and spit out after gargle. The observation-group-patients gargled with Xipayi gingival rinse (Xinjiang Qikang Habowei Pharmaceutical Co., Ltd., Z65020012) during ultrasonic subgingival curettage, and treated with the same rinse right along. Patients gargled with 3-5 ml Xipayi gingival rinse solution for 2-3 min and repeated 3-5 times/d, which can be swallowed. Both groups received 4 consecutive weeks of treatment. The patients were required not to drink or eat within 1 hour after the medicine was rinsed, or to apply water for repeated mouthwash. All examinations and treatments were performed by the same periodontal specialist.

### *Observation of indicators*

The changes of periodontal indexes were as follows: the changes in periodontal indexes of the two groups were evaluated before and after treatment. The indexes included probing depth (PD), sulcus bleeding index (SBI), clinical attachment level (CAL) and plaque index (PLI).

The changes of inflammatory factor degree were as follows: the gingival crevicular fluid of the two groups were collected before and after treatment, and the degree of its inflammatory factors, including high-sensitivity C-reactive protein (hs-CRP), tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ) and interleukin-6 (IL-6), were detected by enzyme-linked immunosorbent assay (ELISA).

Occlusal efficiency: the occlusal indexes of the two groups, including the occlusal time and the balance of occlusal force in each side, were detected pre- and post-treatment and evaluated by T-scan III 7.01 digital occlusal analysis system.

Masticatory efficiency: the masticatory efficiency of the two groups was tested and evaluated by Photoshop and ViewGun before and after treatment. The standard deviation of the pixel

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**Table 1.** Comparison of clinical data between the two groups

Group	Case	Gender		Age (years $\bar{x} \pm sd$ )	course of disease (years, $\bar{x} \pm sd$ )	Illness	
		Male	Female			moderate	severe
Observation group	49	27	22	45.86±13.29	6.84±1.75	31	18
Control group	49	29	20	44.73±12.61	6.52±1.68	34	15
t/ $\chi^2$	-	0.167		0.432	0.923	0.411	
P	-	0.683		0.667	0.358	0.521	

**Table 2.** Changes of periodontal index before and after treatment in the two groups

Group	Time	Probing depth (mm)	Sulcus bleeding index	Attachment level (mm)	Plaque index
The observation group (n=49)	Pre-treatment	5.42±0.25	3.81±0.35	4.18±0.33	2.84±0.26
	Post-treatment	3.17±0.27*	1.27±0.23*	2.27±0.16*	1.21±0.17*
	t	42.803	42.454	36.456	36.730
	P	0.000	0.000	0.000	0.000
The control group (n=49)	Pre-treatment	5.39±0.33	3.76±0.24	4.21±0.29	2.89±0.31
	Post-treatment	3.86±0.24	1.72±0.31	2.95±0.22	1.84±0.20
	t	26.247	36.424	24.230	19.923
	P	0.000	0.000	0.000	0.000

Note: Compared with the control group in the same period, \* $P<0.05$ .

tonal value of red and green gum was calculated with a range between 0-1. The smaller standard deviation indicated the higher masticatory efficiency.

## Statistical analysis

Data processing and analysis were conducted by statistical software SPSS 22.0. The comparison for measurement data was performed by *t* test and the comparison for enumeration data was done by  $\chi^2$  test.  $P<0.05$  indicated that the difference was statistically significant.

## Results

### Comparison of clinical data between the two groups

There was no statistical difference in clinical baseline data between the two groups ( $P>0.05$ ), as shown in **Table 1**.

### Changes in periodontal index

The two groups had insignificant difference in the probing depth, sulcus bleeding index, attachment level and plaque index before treatment ( $P>0.05$ ). The periodontal indexes of the two groups post-treatment decreased critically

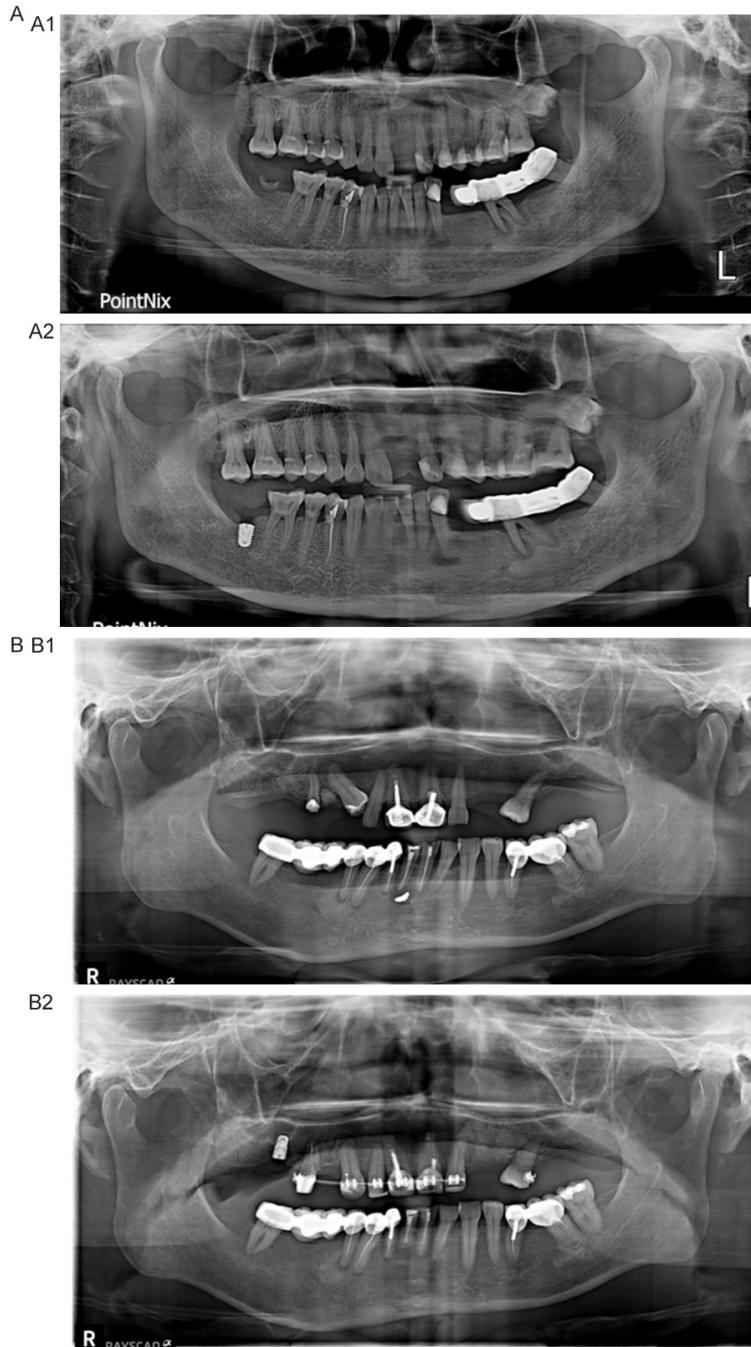
compared to those of pre-treatment ( $P<0.05$ ), and the periodontal index of the observation group was remarkably lower than that of the control group ( $P<0.05$ ), as shown in **Table 2**. The images of typical cases are shown in **Figure 1**.

### Changes of inflammatory factors

The two groups had insignificant difference in degree of inflammatory factors hs-CRP, TNF- $\alpha$  and IL-6 in gingival crevicular fluid before treatment ( $P>0.05$ ). The degree of inflammatory factors in gingival crevicular fluid of the two groups decreased remarkably after treatment ( $P<0.05$ ), and the degree of inflammatory factors in the gingival crevicular fluid of the observation group were notably lower than which of the control group ( $P<0.05$ ), as shown in **Table 3**.

### Changes of occlusal index

The two groups had insignificant difference in the standard deviation of masticatory efficiency before treatment ( $P>0.05$ ). The occlusal time and the balance of occlusal force of each side in two groups were significantly lower than those before treatment ( $P<0.05$ ), and the indexes in the observation group were obviously



**Figure 1.** Typical cases of the two groups before and after treatment. (A) The typical pathological picture of the observation group. A female of 58 years old. The patient had poor overall oral hygiene, such as soft scale, pigment (++), calculus (+++), obvious gingival redness, swelling and atrophy. The patient has a rough feeling under the gingiva. There was a rough feeling of subgingival, and the periodontal pocket was obviously formed. The 21, 34, 35, 37, 47 teeth were missing, and the remaining were loose by 1 to 2 degree (A1) Before treatment; (A2) After treatment. (B) The typical pathological picture of the control group. A female of 50 years old. The patient had poor overall oral hygiene, such as soft scale, pigment (++), calculus (+++), obvious gingival redness, swelling and atrophy. There was a rough feeling of subgingival, and the periodontal pocket was obviously formed. The 14, 16, 17, 23, 24, 26, 27 teeth were missing, and the remaining were loose by 1 to 2 degree (B1) Before treatment; (B2) After treatment.

lower than those in the control group ( $P < 0.05$ ), as shown in **Table 4**.

*Change of standard deviation in masticatory efficiency*

The two groups had insignificant difference in the standard deviation of masticatory efficiency before treatment ( $P > 0.05$ ). The standard deviation of masticatory efficiency in the two groups decreased remarkably after treatment ( $P < 0.05$ ), and the index in the observation group was notably lower than which in the control group ( $P < 0.05$ ), as shown in **Table 5** and **Figure 2**.

**Discussion**

Chronic periodontitis is a chronic oral infection that commonly occurs clinically. The primary manifestations of the disease are non-specific infection of tooth supporting tissues, which can lead to gingival bleeding, progressive loss of attachment, and alveolar bone resorption [9]. The basic treatment of periodontal is one of the effective ways in treating chronic periodontitis. The mechanical methods of supragingival cleansing, subgingival curettage and root planning can effectively remove dental plaque and calculus. However, dental plaque in the bottom of the periodontal pocket and the bifurcation area of the root is difficult to be removed, which may lead to poor treatment effect and result in recurrence. Therefore, adjuvant therapy that targets local medication can effectively improve the clinical efficacy [10, 11].

The main effective components of Xipayi gingival rinse is Chinese herbal medicine, whi-



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**Table 3.** Changes of inflammatory factors in the two groups before and after treatment ( $\bar{x} \pm sd$ )

Group	Time	hs-CRP ( $\mu\text{mol/L}$ )	TNF- $\alpha$ ( $\mu\text{g/L}$ )	IL-6 (ng/L)
The observation group (n=49)	Pre-treatment	23.47 $\pm$ 5.28	22.83 $\pm$ 7.95	6.74 $\pm$ 1.42
	Post-treatment	12.38 $\pm$ 3.94*	13.42 $\pm$ 3.44*	3.02 $\pm$ 0.89*
	t	11.784	7.604	15.538
	P	0.000	0.000	0.000
The control group (n=49)	Pre-treatment	22.96 $\pm$ 4.97	23.42 $\pm$ 8.41	6.83 $\pm$ 1.55
	Post-treatment	15.48 $\pm$ 3.72	15.06 $\pm$ 2.19	4.16 $\pm$ 0.96
	t	8.434	6.734	10.251
	P	0.000	0.000	0.000

Note: Compared with the control group in the same period, \* $P < 0.05$ .

**Table 4.** Changes of occlusal indexes in the two groups before and after treatment

Group	Time	Occlusal time (s)	Balance of occlusal force in each side (%)
The observation group (n=49)	Pre-treatment	0.64 $\pm$ 0.15	14.57 $\pm$ 1.97
	Post-treatment	0.31 $\pm$ 0.11*	9.64 $\pm$ 1.46*
	t	12.419	14.074
	P	0.000	0.000
The control group (n=49)	Pre-treatment	0.61 $\pm$ 0.20	14.76 $\pm$ 1.89
	Post-treatment	0.42 $\pm$ 0.14	11.36 $\pm$ 0.97
	t	5.448	11.203
	P	0.000	0.000

Note: Compared with the control group in the same period, \* $P < 0.05$ .

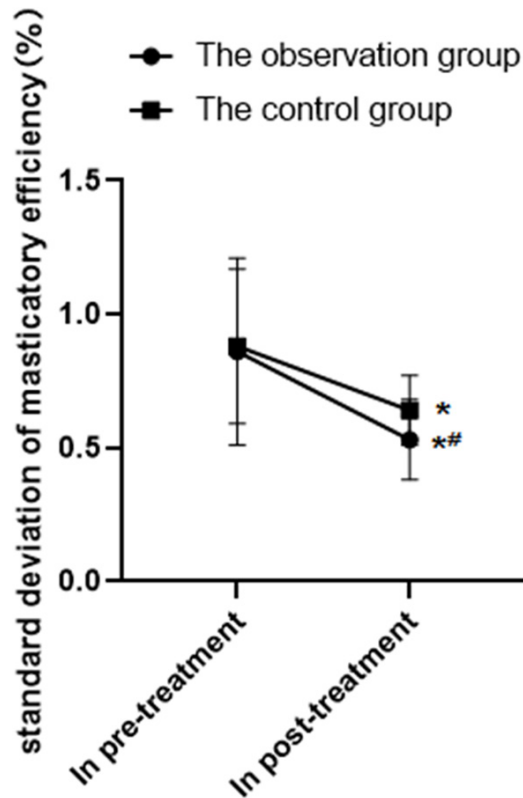
**Table 5.** Changes of standard deviation of masticatory efficiency in the two groups before and after treatment ( $\bar{x} \pm sd$ )

Group	Number of cases	In pre-treatment	In post-treatment	t	P
The observation group	49	0.86 $\pm$ 0.35	0.53 $\pm$ 0.15	6.066	0.000
The control group	49	0.88 $\pm$ 0.29	0.64 $\pm$ 0.13	5.286	0.000
t	-	0.308	3.879	-	-
P	-	0.759	0.000	-	-

ch can stabilize Qi and stop bleeding. It has the effects of strengthening gingival, clearing blood and relieving pain, and is often used to treat periodontal diseases such as gingival bleeding, dental erosion, loosening and displacement, and masticatory weakness [12]. Studies have proved that Xipayi gingival rinse has bactericidal, anti-inflammatory and analgesic effects, imposing considerable inhibitory effects on porphyromonas gingivalis, Prevotella intermedia, Fusobacterium nucleatum and other usual periodontal pathogens. The gargle can effectively reduce the accumulation of dental plaque and bleeding in gingival sulcus, thus significantly improving the periodontal health [13, 14]. In addition, previous studies have also shown that Xipayi gingival rinse can effectively inhibit the

accumulation of endotoxin, which is another crucial factor that causes periodontal disease [15].

In this study, we explored and analyzed the effect and masticatory function of ultrasonic subgingival curettage combined with rinsing and gargling of Xipayi gingival rinse on patients with moderate to severe chronic periodontitis. The two groups had insignificant difference in the probing depth, sulcus bleeding index, attachment level and plaque index before treatment ( $P > 0.05$ ). The periodontal indexes, probing depth, sulcus bleeding index, attachment level and plaque index of the two groups after treatment decreased critically ( $P < 0.05$ ), and the periodontal index of the observation group



**Figure 2.** Changes of standard deviation of masticatory efficiency in the two groups before and after treatment. Note: Compared with the same group before treatment, \* $P<0.05$ ; compared with the control group in the same period, # $P<0.05$ .

was remarkably lower than which of the control group ( $P<0.05$ ). The degree of inflammatory factors in gingival crevicular fluid of the two groups also decreased remarkably after treatment ( $P<0.05$ ), and the degree of inflammatory factors of the observation group was notably lower than which of the control group ( $P<0.05$ ). The results, which are similar to those reported by other scholars [16, 17], indicated that the combinative usage of Xipayi gingival rinse can effectively improve the periodontal condition of patients, reduce their gingival bleeding and dental plaque, and inhibit the degree of inflammation, which is more effective in treating the chronic periodontitis. The common practice of Xipayi gingival rinse is by gargling, and the general active ingredients can only enter the subgingival about 0.2 mm, with therapeutic effect limited on bacteria and inflammation in deep periodontal pockets. Therefore, when performing ultrasonic subgingival curettage in this study, an ultrasonic scaler with a rinsing system

was adopted to simultaneously deliver the rinse to patients' periodontal fundus pocket. This can not only achieve the effect of flushing, but also deliver medicine at the same time [16, 17]. The cavitation effect of ultrasonic waves causes Xipayi gingival rinse to produce a large number of tiny bubbles. The burst of the bubbles produces high-pressure shock, so that the active ingredients penetrate into the periodontal in all directions, promoting tissue cell metabolism, and effectively inhibiting gum bleeding and inflammation [18, 19]. In addition, gargle treatment for a period can further inhibit the periodontal inflammation and accelerate the recovery of periodontitis [20].

In this study, the occlusal time and the balance of occlusal force of patients decreased significantly after treatment compared with those before treatment ( $P<0.05$ ), and the indexes in observation group were dramatically superior to those in control group ( $P<0.05$ ). It is generally believed that the occlusal time can be used to measure the stability of occlusion. The shorter occlusion time represents the more stable occlusion. Tooth loosening or displacement caused by periodontal inflammation prolongs the upper and lower occlusal time. After effective treatment, the periodontal inflammation of patient is controlled, the periodontal support is enhanced and the looseness of the teeth is reduced and stabilized, thereby the occlusal time is reduced [21, 22]. In addition, the smaller the balance of the bite force on each side indicated the smaller difference in the percentage of bite force. Patients with moderate to severe periodontitis have unilateral mastication due to loose teeth and weak occlusion. Other factors that lead to unbalanced occlusal force were inflammation of periodontal tissue and tooth displacement. While after treatment, when periodontal health is restored and the tooth occlusal force increased, both sides can be used in a balanced manner during chewing, revealing that the number of contacts between occlusal points of two sides and the occlusal area tend to be balanced [23]. Moreover, it was found in the study that the standard deviation of masticatory efficiency in two groups decreased remarkably after the treatment ( $P<0.05$ ), and the index in the observation group was obviously lower than which in the control group ( $P<0.05$ ). This indicates that the masticatory mixture is more uniform, the masticatory

efficiency is increased after treatment, and the occlusal condition and masticatory efficiency of patients treated with Xipayi gingival rinse are more effective. Therefore, it is considered that Xipayi gingival rinse has better antibacterial effect and more effective inhibition on periodontitis.

The results of the study are consistent with those reported by other scholars [24, 25]. The possible mechanism is that Xipayi gingival rinse delivered by ultrasonic subgingival curettage was sent to the bottom of periodontal pocket and exerted deep administrative effect, thereby effectively inhibiting the periodontal inflammation and improving the gingiva health. The combined therapy of ultrasonic subgingival curettage and Xipayi gingival rinse can effectively cure moderate to severe chronic periodontitis, improving the periodontal condition and inhibiting periodontal inflammation of patients. Meanwhile, the treatment helps to improve the stability and force of patients' occlusion, thus improving the efficiency of mastication and is worthy of clinical application.

### Disclosure of conflict of interest

None.

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