Tropical Journal of Pharmaceutical Research November 2023; 22 (11): 2373-2380
ISSN: 1596-5996 (print); 1596-9827 (electronic)

Available online at http://www.tjpr.org
http://dx.doi.org/10.4314/tjpr.v22i11.18

Original Research Article

Effect of Dentong Xiaoyanling and tinidazole gargle on periodontal parameters in chronic periodontitis, gingival sulcus factor and oral health

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Sent for review: 9 June 2023 *Revised accepted: 1 November 2023*

Abstract

Purpose: *To investigate the effect of concentrated tinidazole gargle combined with Dentong Xiaoyanling on chronic periodontitis.*
Methods: *Ninety-six (96) patients with chronic periodontitis admitted in Chun'an County Traditional Chinese Hospital, Qiandaohu Town, China between January 2021 and December 2022 were randomly divided into two groups: control group (treated with concentrated tinidazole gargle) and study group (treated with concentrated tinidazole gargle + Dentong Xiaoyanling). Periodontal indicators, Gingival sulcus factor (GSF), oral health status, clinical efficacy and adverse reactions were compared between the two groups.*
Results: *There were no significant changes ($p > 0.05$) in periodontal indicators, GSF or oral health score between the two groups prior to therapy. However, following treatment with Dentong Xiaoyanling and/or concentrated tinidazole gargle, the periodontal indicators, GSF and oral health score of the two groups reduced significantly ($p < 0.05$), with more pronounced reductions in the study group. Clinical efficacy in the group treated with a combination of concentrated tinidazole gargle and Dentong Xiaoyanling was 91.67 %, which was significantly higher ($p < 0.05$) than that of control group (75 %). Furthermore, there was no significant difference in the incidence of adverse reactions between the two groups pre- and post-treatment ($p > 0.05$).*
Conclusion: *Treating chronic periodontitis with concentrated tinidazole gargle + Dentong Xiaoyanling alleviates local inflammatory reaction of gums, enhances recovery from symptoms and improves oral health. Future approaches will require a larger sample size from diverse clinical settings to confirm the effectiveness of this approach.*

Keywords: *Tinidazole gargle, Dentong Xiaoyanling, Chronic periodontitis, Oral health, Gingival sulcus factor (GSF), Periodontal index*

Tropical Journal of Pharmaceutical Research is indexed by Science Citation Index (SciSearch), Scopus, Web of Science, Chemical Abstracts, Embase, Index Copernicus, EBSCO, African Index Medicus, JournalSeek, Journal Citation Reports/Science Edition, Directory of Open Access Journals (DOAJ), African Journal Online, Bioline International, Open-J-Gate and Pharmacy Abstracts

INTRODUCTION

Chronic periodontitis (CP) is one of the most common infectious illnesses in clinical dentistry with patients typically infected with various periodontal pathogenic bacteria [1]. Although there is no uniform standard for treating chronic periodontitis at the moment, treatment principle

emphasizes the management and removal of dental plaque, calculus and other pathogenic irritants, effectively decreasing gingival inflammation [2].

Drug therapy, comprising anti-inflammatory and antibacterial drugs, is the primary treatment for chronic periodontitis. Commonly used anti-inflammatory drugs are non-steroidal pharmaceuticals, while anti-bacterial drugs commonly used are nitroimidazoles and macrolides [3]. Single-drug therapy has a far from perfect clinical outcome, thus treating patients with a combination of Western and Chinese medicine has emerged as one of the major foci of clinical research [4]. Tinidazole rinse concentrate is a broad-spectrum antibacterial agent. Its antibacterial activity is achieved by preventing the formation of harmful bacterium DNA. Associated local inflammatory response will be decreased at any time once the patient's local pathogenic germs are under control and clinical symptoms will noticeably improve.

Primary constituents of *Dentong Xiaoyanling* include *gypsum, mustard gypsum, Qing dai, Angelica Dahurica, Fang Feng,* and others. Its clinical effects include carbuncle clearance, as well as pain alleviation, which is critical in the etiology of dental disorders such as chronic periodontitis and gum inflammation.

Therefore, this research investigates the efficacy of the combination of tinidazole gargle and *Dengtong Xiaoyanling* for the treatment of chronic periodontitis.

METHODS

Clinical information

The study was conducted on 96 patients with chronic periodontitis admitted to the Chun'an County Traditional Chinese Hospital between January 2021 and December 2022. The patients were equally grouped into study and control groups, in compliance with the random number table rule. The protocol was approved by the Ethics Committee of Chun'an County Traditional Chinese Medicine Hospital (approval no. 2021111). All procedures were performed according to the declaration of Helsinki [5].

Inclusion criteria

Patients who met the following criteria were included in the study: meeting the relevant diagnostic criteria for chronic periodontitis in Periodontology; age ≥ 18 years; good clinical compliance; informed consent was obtained from all patients.

Exclusion criteria

Patients were excluded from the study based on the following criteria: pregnant or lactating patients; patients with severe cardiac, hepatic and renal abnormalities; patients with other infectious diseases; and patients who have not received anti-inflammatory and antibacterial interventions within one month prior to enrollment.

Treatments

Control group

Patients in this group were given a concentrated tinidazole gargle solution (Jiangsu Chenbangde Pharmaceutical Co., Ltd.; State Drug Quantifier approval no. H20103473; specification: 0.2 %). Fifty milliliters (50 mL) of warm, boiled water was mixed with 2 mL of concentrated tinidazole gargle solution. The solution was gargled for one minute before being spat out. This was repeated three times daily.

Study group

Patients in this group were given both tinidazole gargle and *Dentong Xiaoyanling* pellets (Henan Furentang Pharmaceutical Co., Ltd; State Drug Administration approval no. Z10983121; specification: 20 g) orally, three times daily, similar to control group. Both groups of patients were treated for one month and then observed to compare the efficacy.

Evaluation of parameters/indices

Periodontal indices

The Williams probe was used to test the periodontal-related indices of the patients which include bleeding index (BI), periodontal pocket depth (PD), gingival index (GI), gingival sulcus bleeding index (SBI) and plaque index (PLI).

Gingival sulcus factor (GSF)

Enzyme-linked immunosorbent assay (ELISA) was used to determine the levels of pentraxin 3 (PTX3), matrix metalloproteinase 8 (MMP-8) and osteoclast differentiation factor (RANKL) in gingival sulcus fluid taken from the deepest single tooth of each patient. The kits used were purchased from Wuhan Finn Biologicals and relevant operations were performed in strict accordance with the accompanying instructions.

Oral health status

Oral health before and after treatment was evaluated using the Oral Health Impact Profile – 49 (OHIP-49) scale consisting of 49 questions divided into seven domains as follows: functional limitations (0 – 9), Physical pain (0 – 9), psychological discomfort (0 – 5), physical ability limitation (0 – 9), mental ability limitation (0 – 6), social ability loss (0 – 5), physical and mental defects (0 – 6). Total score was 0 – 114 points and the higher the score, the lower the quality of life.

Clinical efficacy

In accordance with the relevant standard in Oral Internal Medicine, the criteria for determining clinical efficacy are as follows:
Cured (C): Gum swelling and pain, bleeding, tooth loosening and other related clinical symptoms have disappeared, and masticatory function and periodontal pockets return to normal.

Effective (E): Gum swelling and pain, bleeding, tooth loosening, and other related clinical symptoms improves significantly, masticatory function improves, but not completely disappeared or completely improved and periodontal pockets become shallow.

Invalid: related clinical symptoms were not significantly improved or aggravated.

Total effectiveness (TE) of therapy was calculated using Eq 1.

TE = C+E …….. (1)

Statistical analysis

The data were analyzed using SPSS 15.0 software. Comparison of measurement data was done using *t*-test and Chi-squared test for count data. $P < 0.05$ indicates a significant difference.

RESULTS

Baseline data

There was no significant difference between the groups with respect to the average age and duration of illness ($p > 0.05$), as shown in Table 1.

Periodontal indices

Table 2 highlights the comparison of periodontal indicators in the pre-and post-treatment groups. No significant change was observed in the periodontal indices of both groups before treatment ($p > 0.05$). However, there was a significant reduction in the periodontal indices ($p < 0.05$) after treatment. The difference was lower in study group than in control group.

Table 1: Clinical data of the two groups (n = 48)

Indicator		Study group	Control group	*t*	*P*-value
Mean age (years)		37.58±3.05	37.63±2.98	0.0812	0.9354
Mean duration of illness (years)		4.17±0.48	4.19±0.53	0.1938	0.8468
Academic level (n (%))	Junior High school and below	2 (4.17)	3 (6.25)		
	Junior High school	8 (16.67)	9 (18.75)		
	Junior High school and above	38 (79.17)	36 (75.00)		
Gender (n (%))	Male	28 (58.33)	29 (60.42)	0.0432	0.8354
	Female	20 (41.67)	19 (39.58)		
Regular brushing pattern (n (%))	Yes	38 (79.17)	37 (77.08)	0.0610	0.8050
	No	10 (20.83)	11 (22.92)		
Teeth grinding (n (%))	Yes	12 (25.00)	13 (27.08)	0.0541	0.8161
	No	36 (75.00)	35 (72.92)		
Smoking history (n (%))	Yes	26 (54.17)	29 (60.42)	0.3831	0.5359
	No	22 (45.83)	19 (39.58)		
History of alcohol consumption (n (%))	Yes	36 (75.00)	37 (77.08)	0.0572	0.8110
	No	12 (25.00)	11 (22.92)		
Gum bleeding (n (%))	Yes	41 (85.42)	42 (87.50)	0.0890	0.7655
	No	7 (14.58)	6 (12.50)		
Subgingival plaque (n (%))	Yes	43 (89.58)	40 (83.33)	0.8007	0.3709
	No	5 (10.42)	8 (16.67)		

Table 2: Comparison of periodontal indices between groups (n = 48)

Indicator		Study group	Control group	*t*	*P*-value
BI	Before Treatment	2.71±0.50	2.73±0.54	0.1883	0.8511
	After Treatment	1.75±0.53	2.10±0.52	3.2658	0.0015
	t	9.1282	5.8223	-	-
	P-value	0.0000	0.0000	-	-
PD (mm)	Before Treatment	3.75±0.35	3.78±0.40	0.3911	0.6966
	After Treatment	2.51±0.26	3.15±0.33	10.5543	0.0000
	t	19.7039	8.4172	-	-
	P-value	0.0000	0.0000	-	-
GI	Before Treatment	4.71±0.62	4.75±0.64	0.311	0.7565
	After Treatment	3.50±0.55	4.10±0.59	5.1536	0.0000
	t	10.1148	5.1735	-	-
	P-value	0.0000	0.0000	-	-
SBI	Before Treatment	4.65±0.60	4.67±0.56	0.1688	0.8663
	After Treatment	2.90±0.52	3.54±0.58	5.6922	0.0000
	t	15.2704	9.7105	-	-
	P-value	0.0000	0.0000	-	-
PLI	Before Treatment	2.67±0.48	2.69±0.51	0.1978	0.8436
	After Treatment	1.75±0.53	2.15±0.50	3.8034	0.0003
	t	8.914	5.2383	-	-
	P-value	0.0000	0.0000	-	-

Gingival sulcus factors

Before treatment, the differences in gingival sulcus factors between the two groups were insignificant ($p > 0.05$). However, gingival sulcus factors decreased significantly in both groups after treatment compared to pre-treatment levels ($p < 0.05$). The difference was lower in study group than in control group (Table 3).

Oral health status

Results of the evaluation of oral health status of patients in both groups are presented in Table 4. Before treatment, no significant difference was observed in oral health scores of the groups ($p > 0.05$). After treatment, oral health scores of the two groups were significantly reduced, with the score recorded in study group lower than that of control group ($p < 0.05$).

Clinical efficacy

The clinical efficacy of treatment regimen in the pre-and post-treatment groups is presented in Table 5. Treatment with a combination of tinidazole gargle and *Dengtong Xiaoyanling* showed a significantly higher ($p < 0.05$) efficacy (91.67 %) compared with control group (75.00 %).

Adverse reactions

The incidence of adverse reactions arising from the treatments is compared in Table 6. There was no significant difference in the incidence of adverse reactions between the two groups ($p > 0.05$).

Table 3: Comparison of gingival sulcus factors between groups (n = 48)

Indicator		Study group	Control group	*t*	*P*-value
PTX3 (μg/L)	Before Treatment	5.19±0.52	5.21±0.51	0.1902	0.8495
	After Treatment	3.42±0.34	4.19±0.45	9.4587	0.0000
	t	19.7379	10.3901	-	-
	P-value	0.0000	0.0000	-	-
MMP-8 (ng/mL)	Before Treatment	31.54±3.16	31.57±3.09	0.047	0.9626
	After Treatment	16.35±1.68	20.15±2.04	9.9621	0.0000
	t	29.4061	21.3684	-	-
	P-value	0.0000	0.0000	-	-
RANKL (pg/mL)	Before Treatment	163.35±16.05	164.05±15.98	0.2141	0.8309
	After Treatment	116.35±11.25	135.35±12.16	7.9462	0.0000
	T	16.6134	9.9021	-	-
	P-value	0.0000	0.0000	-	-

Table 4: Comparison of oral health status between groups (n = 48)

Indicator		Study group	Control group	*t*	*P*-value
Functional limitations (0-9)	Before Treatment	6.67±0.60	6.69±0.62	0.1606	0.8728
	After Treatment	4.25±0.48	5.04±0.50	7.8967	0.0000
	t	21.8204	14.3523	-	-
	P-value	0.0000	0.0000	-	-
Physical pain (0-9)	Before Treatment	6.71±0.62	6.73±0.64	0.1555	0.8768
	After Treatment	4.50±0.55	5.21±0.54	6.3819	0.0000
	t	18.4742	12.576	-	-
	P-value	0.0000	0.0000	-	-
Psychological discomfort (0-5)	Before Treatment	3.21±0.50	3.23±0.52	0.1921	0.8481
	After Treatment	1.35±0.48	2.21±0.50	8.5964	0.0000
	t	18.5923	9.7961	-	-
	P-value	0.0000	0.0000	-	-
Physical ability Limitation (0-9)	Before Treatment	6.56±0.54	6.58±0.50	0.1883	0.8511
	After Treatment	4.06±0.48	5.21±0.50	11.4952	0.0000
	t	23.9732	13.4232	-	-
	P-value	0.0000	0.0000	-	-
Mental ability limitation (0-6)	Before Treatment	3.00±0.51	3.04±0.54	0.3731	0.7099
	After Treatment	1.00±0.51	2.04±0.54	9.7007	0.0000
	t	19.2117	9.0722	-	-
	P-value	0.0000	0.0000	-	-
Loss of social skills (0-5)	Before Treatment	3.67±0.52	3.65±0.56	0.1813	0.8565
	After Treatment	1.06±0.52	2.04±0.54	9.0569	0.0000
	t	18.6231	14.3383	-	-
	P-value	0.0000	0.0000	-	-
Physical and mental defects (0-6)	Before Treatment	3.56±0.50	3.54±0.50	0.196	0.8451
	After Treatment	1.23±0.47	2.21±0.54	9.4842	0.0000
	t	23.5241	12.5208	-	-
	P-value	0.0000	0.0000	-	-
Total score (0-114)	Before Treatment	33.38±1.42	33.46±1.61	0.2582	0.7968
	After Treatment	17.46±1.09	23.96±1.24	27.2769	0.0000
	t	27.2769	32.3881	-	-
	P-value	0.0000	0.0000	-	-

Table 5: Comparison of clinical efficacy between groups (n, %)

Group	Cured	Effective	Ineffective	Total effective
Study	29 (60.42)	15 (31.25)	4 (8.33)	44 (91.67)
Control	22 (45.83)	14 (29.17)	12 (25.00)	36 (75.00)
Chi-square value		-		4.8000
P-value		-		0.0285

Table 6: Comparison of adverse reactions between groups (n, %)

Group	Vomiting	Metallic taste in my mouth	Reduced appetite	Nausea	Total effective
Study	2 (4.17)	1 (2.08)	1 (2.08)	1 (2.08)	5 (10.42)
Control	1 (2.08)	2 (4.17)	1 (2.08)	0 (0.00)	4 (8.33)
Chi-square value					0.1226
P-value					0.7262

DISCUSSION

Chronic periodontitis is a common clinical condition and its incidence has remained high in recent years. The clinical manifestations in patients with chronic periodontitis are mainly tooth swelling, loosening and bleeding, which are symptoms associated with inflammatory reactions. The severity of the condition may further lead to gingival ulceration and overflow of pus. This, in turn, may lead to systemic inflammatory reactions, resulting in a reduced quality of life in patients [4]. Clinical studies have shown that the mechanisms leading to the development of chronic periodontitis are relatively complex [6,7]. It has been suggested that the narrowing of the patient's dental space increases the opportunities for the growth of pathogenic microorganisms [8]. The pathogenic microorganisms present in the patient's teeth

replicate and multiply, further invading the patient's periodontal tissues in depth, intensifying the local inflammatory reaction process, deepening the inflammatory damage and eventually causing the patient to exhibit various typical symptoms of chronic periodontitis. This happens when the immune system is stimulated by internal and external factors that affect its normal functioning [9,10].

Currently, pharmacological therapies are the primary form of treatment for chronic periodontitis [11,12]. Previous investigations have used a single medication to treat chronic periodontitis, but there is still much room for improvement in terms of overall clinical efficacy [13]. Using a strategy that integrates Chinese and Western medicine, the combination of tinidazole and *Dentong Xiaoyanling* is used in the hospital for the clinical treatment of chronic periodontitis. In Chinese medicine, periodontitis, chronic periodontitis and gingivitis are referred to as "dental caries". These symptoms are brought on by poor oral hygiene in patients. Oral disease etiology is highly symptomatic. By combining Western medicine and Chinese antibacterial medications, it is possible to fully exploit the synergistic effect of the two, achieving the effect of treating both symptoms and root causes, and greatly improving clinical efficacy [14,15].

Periodontal indices such as BI, PD, GI, SBI, and PLI are used as references for the diagnosis and treatment of a variety of dental diseases in clinical practice [16]. After the patients received the combined Chinese and Western medicine treatment regimen, the improvement of the above periodontal indicators in study group was much better than in control group and the difference was significant. This finding implies that combining tinidazole gargle with *Dentong Xiaoyanling* successfully improves patients' periodontal tissues. Clinical studies have found that a large number of inflammatory factors exist in the gingival sulcus fluid of patients with chronic periodontitis which have been implicated in the generation and progression of periodontitis [17-19]. Matrix metalloproteinase 8 is a collagenase that attaches to type I collagen and interacts with it to break it down. When pathogenic germs enter the body, they swiftly bind to Toll-like receptors, triggering a variety of cells to act and release PTX3 factors. RANKL, a protein secreted by the mesenchymal cells and lymphocytes, is also a tumour necrosis factor receptor. Matrix metalloproteinase 8 increases the activity of other MMPs and promotes the degradation process, which contributes to the formation of osteoclasts and leads to increased bone resorption. Activation of B cells causes a continuous inflammatory response that exacerbates the erosive effect on alveolar bone. Results from ELISA suggest that combining Chinese and Western medicine treatment methods is effective in inhibiting local inflammatory response process in patients with chronic periodontitis, thereby preventing damage of periodontal tissues by inflammatory response.

Clinical evaluation of oral health using OHIP-49 scale has been shown to have great reliability and validity [20]. This evaluation technique is a part of the evaluation index of patients' subjective emotions and the evaluation dimension is made up of seven aspects [21]. Study group's post-treatment OHIP-49 scale scores and combined scores for seven dimensions were significantly lower than those of control group ($p < 0.05$). This demonstrates that patients acknowledged the value of this treatment method that combined Chinese and Western medicine. There was no discernible difference in the frequency of adverse reactions between study and control groups, and study group's overall effective rate was higher. This highlights the relative benefits of treating chronic periodontitis with a combination of Western and Chinese therapy.

Limitations of the study

The study's findings do, however, have some limitations because the hospital, which is a very small setting, provided all the study cases.

CONCLUSION

The combination of *Dentong Xiaoyanling* and concentrated tinidazole rinse improves the local inflammatory response of patients' gums, alleviates symptom relief, enhances clinical efficacy and boosts oral health in patients with chronic periodontitis. In future studies, sample size should be enlarged to assess clinical effectiveness and genetic variabilities of this approach in multiple centers.

DECLARATIONS

Acknowledgements

None provided.

Funding/Sponsorship

None provided.

Conflict of Interest

No conflict of interest associated with this work.

Contribution of Authors

We declare that this work was done by the authors named in this article and all liabilities pertaining to claims relating to the content of this article will be borne by the authors. Junxian Xu and Lanfang Lu designed the study and carried it out, supervised the data collection, analyzed and interpreted the data, prepared the manuscript for publication, and reviewed the draft of the manuscript. All authors read and approved the manuscript.

Ethical Approval

This study was approved by the Ethics Committee of Chun'an County Traditional Chinese Medicine Hospital (approval no. 2021111).

Availability of Data and Materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Use of Artificial Intelligence/Large Language Models

None provided.

Use of Research Reporting Tools

None provided.

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