Original Article

The Clinical Effectiveness of Subgingival Irrigation with Povidone-Iodine and Hydrogen Peroxide in Treatment of Moderate to Severe Chronic Periodontitis

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KEY WORDS
Dental scaling;
Root planing;
Povidone Iodine;
Hydrogen peroxide;
Periodontitis

Received Nov. 2011;
Received in revised form March 2012 ;
Accepted May 2012

ABSTRACT

Statement of Problem: Although mechanical debridement is considered as the conventional technique in the management of chronic periodontitis, the locally delivered antiseptic agents have also been investigated as an adjunctive therapy.

Purpose: The purpose of this study was to investigate the clinical effectiveness of subgingival irrigation with polyvinylpyrrolidone-Iodine (PVP-I) 10%, H_2O_2 3%, and the combination of both in the measurement of probing depth and plaque and gingival indices of patients with moderate to severe chronic periodontitis.

Materials and Method: In this double-blind randomized clinical trial, 16 patients with moderate to severe periodontitis were selected using the simple random sampling method. They had at least one tooth with a probing depth ≥5 mm in each quadrant and had undergone phase I of periodontal therapy one month after dental scaling, The initial probing depth, plaque, and gingival indices were recorded and the selected teeth were randomly irrigated with PVP-I 10%, H_2O_2 3%, H_2O_2 3% + PVP-I 10%, or normal saline. The measurements were repeated five weeks after the procedure. The data were analyzed through running paired-samples t-test, analysis of variance (ANOVA), Wilcoxon Signed Rank Test, and Kruskal-Wallis Test.

Results: The mean differences in probing depth before and after subgingival irrigation in patients who were treated with normal saline, H_2O_2, PVP-I, and PVP + H_2O_2 were 1.29 mm, 1.35 mm, 1.47 mm, and 1.71 mm, respectively. This indicated a significant difference among all the groups (p <05). Furthermore, PVP-I had a positive effect on the gingival index but it had no significant effect on the plaque index.

Conclusion: Subgingival irrigation is an effective adjunctive therapy to mechanical debridement in treating moderate to severe chronic periodontitis.

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Introduction

Periodontal problems have been considered as major health issues in different populations for a long time [1]. Conventional therapeutic approaches for controlling chronic periodontitis include mechanical debridement and elimination of the local pathogens and affected tissues in the periodontal pocket using the subgingival scaling and root planing (SRP) procedures [2]. The clinician's skill and experience in gaining appropriate access to deep pockets on the one hand, and the invasion of bacteria in the periodontal tissues on the other hand, result in varying success rates of SRP among different patients. Bacterial invasion necessitat-

es the use of local or systemic antimicrobial agents [3].

Subgingival irrigation is an easy method that can be used as an adjunct to mechanical debridement. Different types of solutions with various concentrations are used for this purpose and the antimicrobial agent, regardless of its type and concentration, is forced into the periodontal pocket with a syringe. Chlorhexidine has been the most potent and, probably, the most commonly used agent in periodontal therapies for a long time. However, because of its unfavorable taste and related side effects, clinicians have turned their attention to the alternative agents [4].

Iodine and its compounds, such as polyvinylpyrrolidone-Iodine (PVP-I) are a large group of antiseptics with a broad spectrum of effect used widely in different areas of medicine. In periodontal treatments, even a brief exposure of 15 seconds to PVP-I can kill two of the major periodontal pathogens i.e. Porphyromonas gingivalis and Aggregatibacter actinomycetemcomitans [5]. A five-minute exposure can result in the elimination of yeasts and other bacteria [6]. PVP-I is also effective in deactivating the herpes simplex viruses which are resistant to chlorhexidine [7].

Surely, many patients with periodontal problems can be cured by the surgical approach for pocket reduction. However, some other patients might favor non-surgical procedures due to systemic diseases, fear of surgery, postoperative cosmetic considerations, or financial problems. The purpose of the present study was to introduce an applicable, painless, non-invasive, and cost effective method to control the periodontal conditions in deep pockets.

This study aimed to evaluate the clinical effectiveness of subgingival irrigation with PVP-I 10%, H_2O_2 3% and the combination of both in the measurement of probing depth and plaque and gingival indices of patients with moderate to severe chronic periodontitis.

Materials and Method

This double-blind randomized controlled clinical trial was conducted at the Department of Periodontology, Shiraz University of Medical Sciences, Shiraz, Southern Iran. (RCT registration code: 138902043785N1). From among those who referred to the clinic with moderate to severe periodontitis, 16 patients (7 men and 9 women), aged 30-54 (mean age: 42 years) were recruited.

The participants had at least one posterior tooth with a pocket depth of 5 mm or more in each quadrant of the dentition and had undergone phase I of the periodontal therapy. In total, 64 periodontal pockets, 4 pockets for each patient, with a depth of 5 mm or more in each quadrant were enrolled and randomly divided into four groups of 16. The cases having allergy to iodine, thyroid dysfunction, requiring antibiotic prophylaxis prior to dental treatment, SRP within the preceding three months, pregnancy, and any medical condition, which comprised a contraindication for any routine dental treatment, were excluded from this study.

After obtaining written informed consent from the patients, they initially completed phase I of the experiment which consisted of oral hygiene instructions (OHIs) and mechanical debridement (approval reference number from Ethics Committee of SUMS: ct-87-4005). OHIs were given to all the participants by a single operator. The participants used the same type of toothbrush. Subsequently, a senior dental student performed SRP for each quadrant for at least one hour and under the supervision of a periodontal faculty member. The OHIs and SRP were repeated at one-week intervals (for 4 weeks) and at the end of each session, the patients received instructions on how to floss their teeth. Four weeks after the final scaling session, using a Williams probe on all tooth surfaces, the following indices were recorded by a periodontist: plaque and gingival indices (Loe and Silness), pocket depth, and keratinized gingival recession. Gingival index was determined through gingival discoloration, inflammation, and the changes which had occurred in the texture. The plaque index was recorded, based on plaque accumulation around the tooth, and graded accordingly.

Subsequently, one posterior tooth from each quadrant was chosen and randomly allocated to subgingival irrigation with one of the following solutions: (1) normal saline, (2) PVP-I 10%, (3) H_2O_2 3%, or (4) H_2O_2 3% + PVP-I 10%.

The second operator performed subgingival irrigation using a sterile insulin syringe with a blunt needle. The needle was marked at 1 mm distance from the tip with a conventional injection needle and 1 ml

Table 1 Pocket depth before and after subgingival irrigation (mm)

Group	Pocket depth (mm)		Mean difference	SD		P value
	Before	After		Before	After	
Normal Saline	5.05	3.76	1.29	2.015	1.715	0.001
PVP-I 10%	5.29	3.82	1.47	1.448	1.667	0.001
H_2O_2 3%	5.59	4.24	1.35	1.460	1.200	0.001
H_2O_2 3% + PVP-I 10%	5.76	4.06	1.71	1.886	1.678	0.001

from each of the test solutions was drawn into each syringe. The teeth were initially isolated with a cotton roll and the needle was gently inserted into the 1 mm depth of the periodontal pocket to ensure delivery of the irrigation solutions to the entire pocket. In the first three groups, it took 5 minutes for the pockets to be filled with the irrigant. In the fourth group, the pockets were irrigated first with H_2O_2 3%, for 20 minutes, and then with PVP-I 10%, for 5 minutes. A suction tube was inside the patients' mouth during subgingival irrigation.

All measurements were repeated by the first operator after 5 weeks. The data was analyzed using SPSS software, version 10 and through running paired-samples t-test, analysis of variance (ANOVA), Wilcoxon Signed Rank Test, and Kruskal-Wallis Test.

Results

All groups showed a significant difference between the mean pocket depth before and after subgingival irrigation (table 1).

Considering reduction of the pocket depth, there was no significant difference between the control group and the experimental groups (table 2).

Although the statistical analysis showed improvement in gingival & plaque indices in all the groups after subgingival irrigation, this finding was significant only in the gingival index in the PVP-I group (tables 3 and 4).

Table 2 Comparison between the control group and the experimental groups in terms of mean pocket reduction

Groups	Mean difference in pocket depth between each group and the control group	P. value
10% PVP-I	0.18	0.982
H_2O_2 3%	0.06	0.999
H_2O_2 3% + PVP-I 10%	0.42	0.815

Discussion

Complete elimination or reduction of the microbial pathogens in the affected area is the key factor to successful management of periodontal infections. This is achieved through surgical or non-surgical treatment procedures. The surgical approach is invasive and may be contraindicated in patients with severe systemic conditions. Furthermore, it is expensive and requires greater experience and skill, all of these limit its applicability. The non-surgical procedure, however, is the inevitable component of periodontal treatment, which is comprised of plaque removal, supra and subgingival scaling, mechanical debridement, root planing, and finally, the adjunct use of antimicrobial agents.

Supra and subgingival irrigation are adjunct treatments which aim to reduce plaque bacteria, non-specifically, and can be performed by the clinician in the office or by the patient at home. Supragingival irrigation reduces coronal bacterial load above the gingival margin and consequently reduces gingival inflammation and the chance of development of gingivitis. Subgingival irrigation, on the other hand, aims at direct reduction of bacterial load in the pocket and results in management of the periodontal conditions. Several studies have been done with the aim of determining the effects of subgingival irrigation on microbiological and clinical parameters of periodontal diseases over the recent decade [8-9]. Scientists have been applying this procedure either alone or as an adjunct to SRP.

The results of this study were in line with the previous reports indicating the effectiveness of subgingival irrigation in reducing the plaque index [9-10]. However, due to the fact that in the previous studies plaque index assessments were based on short term clinical outcomes, they have failed to provide a clear explanation in this regard. It seems that factors such as pain, bleeding, and the patient's lack of knowledge may have affected the results of such studies. Furthermore, proper OHIs and the use of an appropriate toothbrush can help in treating the periodontal conditions [9-10]. In the present study, the gingival index changed,

Table 3 The mean difference in gingival index before and after subgingival irrigation (percentage)

Group	Gingival score (%)				P value
	0	I	II	III	
Normal saline	11.8	0	11.8	0	0.102
PVP-I 10%	17.6	6	22.6	0	0.035
H_2O_2 3%	1.6	1	4.3	1.7	0.187
H_2O_2 3% + PVP-I 10%	13.5	11.8	5.9	5.6	0.80

Table 4 The difference in the plaque index before and after subgingival irrigation (percentage)

Group	Gingival score (%)				P value
	0	I	II	III	
Normal saline	11.8	17.6	0	5.9	1.000
PVP-I 10%	5.9	11.7	5.8	0.5	1.000
H_2O_2 3%	5.9	5.9	11.8	0	0.760
H_2O_2 3% + PVP-I 10%	5.8	5.9	5.9	5.9	0.493

desirably, in line with plaque index in all the groups.

However, due to the concentration of the solute-ion, the change was significant only in the PVP-I 10% group. Based on Nakagawa's study, the concentration used in this study significantly reduces bacterial growth in the subgingival region in vivo [11]. Ciganna et al. confirmed the reduction of inflammation, both clinically and histologically, after subgingival irrigate-on with PVP-I [12]. Additionally, Hoang et al. proposed that the use of PVP-I is associated with a 95% reduction in periodontal pathogens in 44% of the pockets with a depth of 6 mm or more, whereas this rate was only 12.5% in pockets irrigated with normal saline. This finding revealed the antimicrobial efficacy of PVP-I 10% [13].

In 2001, Rosling et al. added PVP-I adjunct to non-surgical periodontal therapy for patients with adv-anced chronic periodontitis. They concluded that PVP-I was an effective agent in reducing the pocket depth and clinical attachment loss [14]. The results of this study is also in line with that of Hoang et al. in that they stated that supplementing mechanical debrid-ement with PVP-I 10% solution reduced periodontal pathogens and facilitated the management of the condition [13].

In another study, Leohardt et al. evaluated the efficacy of PVP-I solution as an adjunct therapy to ultrasonic debridement in controlling periodontal conditions. The results of their study revealed that the non-surgical procedure of using ultrasonic debridem-ent was significantly effective in alleviating the pathologic condition. However, the irrigant did not have a significant impact in this regard [15]. Similarly, Zanatta et al. found out that the adjunct application of PVP-I 0.5% solution to ultrasonic debridement did not have a significant effect on reducing the bacterial load and controlling the periodontal conditions [10].

Leohardt et al. evaluated the antimicrobial effic-acy of PVP-I 0.5% as an adjunct agent to ultrasonic debridement for treatment of severe chronic periodontitis. But they failed to prove its efficacy when it was applied as an adjunction to ultrasonic debridement [8]. Finally, Kotsilkov et al. demonstrated that subgingival irrigation through using PVP-I 10% solution and after mechanical debridement could significantly affect the treatment results [9].

This study failed to reveal a significant differ-ence in gingival index when H_2O_2 3% is used. This is in line with Jones' finding in evaluating the clinical effectiveness of this solution as an oral irrigant [16].

The results of ANOVA test clearly showed that the pocket depth significantly decreased 5 weeks after irrigation in all the groups, with the highest mean diff-erence in the H2O2 3% + PVP-I 10% group (1.71 mm). Similar results were also obtained in a series of studies which used PVP-I as a substitute to water spray in the ultrasonic machine. Two of these studies are Rosling's (pocket depth >6 mm) and Christarsson's (pocket depth >7 mm) [14, 17].

In another study, subgingival irrigation with PVP-I 10% was performed simultaneously with SRP, for teeth with a pocket depth of 6 mm or more. The researchers observed a mean pocket depth reduction of 1.6 mm. However, because of its concurrence with mechanical debridement, the clinical effectiveness of PVP-I could not be assessed alone [13]. To avoid this effect and to minimize the antimicrobial effect of mechanical debridement as a confounding factor, the researchers tried to maintain a 4-week gap between the final scaling session and subgingival irrigation.

The group receiving H_2O_2 3% + PVP-I 10% sho-wed the maximum plaque reduction rate which was suggestive of the synergic effect of H_2O_2 3% and PVP-I 10%. Considering the limitations of this study, the findings indicated that subgingival irrigation with any solution (antimicrobial agents or normal saline) and as an adjunct therapy to mechanical debridement can help in achieving desirable clinical outcomes.

Conclusion

Subgingival irrigation can be an adjunct therapy to mechanical debridement in moderate to severe chronic periodontitis, which can help in having satisfactory clinical outcomes. The combination of H_2O_2 3% + PVP-I 10% yields the more favorable results and the clinicians are advised to supplement SRP with subgingival irrigation to obtain better results.

Acknowledgment

This manuscript has been derived from undergraduate thesis, No, 1114, Shiraz University of Medical Sciences, Dental Faculty.

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