

Comparative Study to Evaluate the Effectiveness of *Aloe vera* and Metronidazole in Adjunct to Scaling and Root Planing in Periodontitis Patients

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Abstract:

Background: In this contemporary time, a search for naturotherapies is on the rise due to various side effects of allopathic medications used for periodontal disease. Contemplating this the present study was undertaken to compare the improvement in clinical parameters by evaluating the efficacy of *Aloe vera* to metronidazole, as an adjunct to scaling and root planing (SRP) in chronic periodontitis patients.

Materials and Methods: 60 sites were selected from 20 patients diagnosed with chronic periodontitis, 40 were test sites (20 in each test group), and 20 were control sites. Group I comprised 20 sites which was followed by local application of *A. vera* gel (Curagel), Group II comprised 20 sites which was followed by local application of metronidazole gel (Elyzol) after SRP, and Group III comprised 20 control sites that were only treated with SRP. Clinical parameters were evaluated at 30, 60, and 90 days and compared.

Result: The mean reduction in clinical parameters was statistically significant ($P < 0.0001$). On intergroup comparison of plaque index score, values of Group I with Group II were not significant with $P = 0.86$, of Group I with Group III was statistically significant ($P < 0.05$), and of Group II with Group III was statistically significant ($P < 0.05$). On intergroup comparison of the gingival index, of Group I with Group II was not significant with $P = 0.54$, of Group I with Group III was statistically significant ($P < 0.05$), and of Group II with Group III was statistically significant ($P < 0.05$). On intergroup comparison of probing pocket depth, of Group I with Group II was not significant with $P = 0.25$, of Group I with

Group III was not significant with $P = 0.15$, and of Group II with Group III was statistically significant ($P < 0.05$).

Conclusion: As the results of both test groups (*A. vera* and metronidazole) are comparable, local application of *A. vera* can be an effective and affordable herbal substitute for metronidazole.

Key Words: Anthraquinones, allopathy local drug delivery, naturotherapy

Introduction

Periodontitis is characterized by multifactorial etiology with pathogenic bacteria being a primary etiologic agent that resides subgingival area and initiates a localized inflammatory response that further leads to the destruction of tooth supporting tissues.^{1,2} The conventional treatment method of scaling and root planing (SRP) remains the “gold standard” for the non-surgical management of chronic periodontitis.³ However, access to periodontal pockets cannot be achieved through the SRP and these pockets provide an ideal environment for the growth and proliferation of anaerobic pathogenic bacteria.⁴ Various studies have shown better results with adjunct use of various local drug delivery systems such as tetracycline fibers, metronidazole gel, minocycline ointment and minocycline microspheres, chlorhexidine chip, and doxycycline hyclate, without exposing the individual to systemic complications. Although these agents show remarkable efficacy in improving periodontal health but if natural herbs provide the similar benefits at a low cost and without undesirable side effects in contrast with traditional medicine modalities, their role must be evaluated. *Aloe vera* is a natural therapy that decreases economical burden due to its less cost than antimicrobial formulations. In the various previous studies, the better results of various local antimicrobial delivery systems as an adjunct to SRP than SRP alone have been shown. Metronidazole is the most common broad-spectrum antibiotic and is active against most of the periodontal pathogens.⁵ As anaerobic bacteria are believed to be the predominant causative factor in periodontitis and metronidazole, a member of nitroimidazole class of antibiotics specifically targets anaerobic microorganisms it is in use in the treatment of chronic periodontitis.⁶ The purpose of the present study was to compare the efficacy of *A. vera* to metronidazole, as an adjunct to SRP in patients with chronic periodontitis.

Materials and Methods

20 patients (10 males and 10 females) in the age group of 30-55 years were selected from the department of periodontics who visited for the treatment of chronic periodontitis for the

present randomized controlled study with split-mouth design. Ethical approval was obtained from the Institutional Ethical Committee. A total of 60 sites were selected from 20 patients with probing depth measuring >5 and <8 mm. Three teeth were selected in each patient that readily bleed on the initial visit. Patients who have not undergone any form of periodontal surgical or non-surgical periodontal therapy for the past 6 months and willing to take part in the study and maintain appointments regularly were enrolled for the study. Informed consent was taken from all the subjects. Patients with history of alcohol abuse, current smokers, had systemic diseases such as diabetes, had taken systemic or topical antibiotic therapy or the over the counter antioxidants such as Vitamin C, Vitamin E within the last 3 months, known to be hypersensitive to metronidazole and *A. vera*, pregnant and nursing mothers were excluded from the study. Of the selected 60 sites, 40 were test sites (20 in each test group), and 20 were control sites. Group I comprised 20 sites which was followed by local application of *A. vera* gel (Curagel), Group II comprised 20 sites which was followed by local application of metronidazole gel (Elyzol), and Group III comprised 20 control sites that were only treated with SRP. On the screening day, patients were selected, target sites were identified. Impressions were made for the fabrication of acrylic stents, which were used for measuring the probing depth in target sites. General, oral, and periodontal examinations were carried out. Before SRP at baseline, (day 0) the selected teeth with the site were subjected to assessment of plaque index, gingival index, gingival bleeding index, and probing pocket depth. Thereafter, all the patient underwent full-mouth SRP, which was done using ultrasonic scalers and curettes. Following SRP, metronidazole 25% gel and *A. vera* gel were applied to test sites (Group I and II). The *A. vera* gel and metronidazole were injected into the pockets with a syringe with a blunt needle around the selected teeth in the treatment test sites. Patients were recalled to dental clinic on the 7th day again for the second application of metronidazole 25% gel and *A. vera* gel for the test site. The patients were then appointed to attend the dental clinic on the 30th, 60th, and 90th day and during this visit, the clinical parameters, i.e. plaque index, gingival index, gingival bleeding index both were assessed in control and test groups. Mean and standard deviation were estimated from

the sample for each study group. Mean values were compared by paired *t*-test within the groups, and ANNOVA was used for intergroup comparisons. *P* < 0.05 was considered as the level of significance.

Results

The mean reduction in plaque index score from day 0 to 30 for Group I was 0.42 ± 0.03, for Group II was (0.48 ± 0.12), and for Group III was (0.29 ± 0.27). On day 0-60, mean reduction for Group I was (0.66 ± 0.12), for Group II was 0.66 ± 0.26, and for Group III was 0.44 ± 0.12. On day 0-90, for Group I was 0.70 ± 0.17, for Group II was 0.74 ± 0.22, and for Group III was 0.58 ± 0.12. The values were statistically significant (*P* < 0.0001) (Table 1). On intergroup comparison, Group I with Group II was not significant with *P* = 0.86, Group I with Group III was statistically significant (*P* < 0.05), and Group II with Group III was statistically significant (*P* < 0.05).

The mean reduction in the gingival index from day 0 to 30 for Group I was 0.40 ± 0.11, Group II was 0.37 ± 0.12, and for Group III was 0.24 ± 0.17. The values were statistically significant (*P* < 0.0001). On day 0-60, for Group I was 0.52 ± 0.02, for Group II was 0.56 ± 0.17, and for Group III was 0.29 ± 0.12. The values were statistically significant (*P* < 0.0001). The mean reduction in gingival index score from day 0 to 90 for Group I was 0.72 ± 0.03, for Group II was 0.71 ± 0.14, and for Group III was 0.56 ± 0.12. The values were statistically significant (*P* < 0.0001) (Table 1). On intergroup comparison, Group I with Group II was not significant with *P* = 0.54, Group I with Group III was statistically significant (*P* < 0.05), and Group II with Group III was statistically significant (*P* < 0.05).

The mean reduction in probing pocket depth was from day 0 to 60 for Group I was 1.82 ± 0.28, Group II was 1.79 ± 0.42, and for Group III was 1.11 ± 0.46. The values were statistically significant (*P* < 0.0001). The mean reduction in probing pocket depth from day 0 to 90 for Group I was 1.46 ± 0.08, for Group II was 1.48 ± 0.46, and for Group III was 1.26 ± 0.46. The values were statistically significant (*P* < 0.0001) (Table 1). On intergroup comparison, Group I with Group II was not

Table 1: Comparative evaluation of clinical parameters in periodontitis patients treated with *Aloe vera* in adjunct to SRP, metronidazole in adjunct to SRP and SRP alone.

Variable	Time point compared	Group I (<i>Aloe vera</i> +SRP) mean±SD	P value	Group II (Metronidazole+SRP) mean±SD	P value	Group III (SRP alone) mean±SD	P value
Plaque index	Day 0-30	0.42±0.03	<0.0001	0.48±0.12	<0.0001	0.29±0.07	<0.0001
	Day 0-60	0.66±0.12		0.66±0.26		0.44±0.12	
	Day 0-90	0.70±0.17		0.74±0.22		0.58±0.12	
Gingival index	Day 0-30	0.40±0.11		0.37±0.12		0.24±0.17	
	Day 0-60	0.52±0.02		0.56±0.17		0.29±0.12	
	Day 0-90	0.72±0.03		0.71±0.14		0.56±0.12	
Probing pocket depth	Day 0-60	1.82±0.28		1.79±0.42		1.11±0.46	
	Day 0-90	1.46±0.08		1.48±0.46		1.26±0.46	

SRP: Scaling and root planing, SD: Standard deviation

significant with $P = 0.25$, Group I with Group III was not significant with $P = 0.15$, and Group II with Group III was statistically significant ($P < 0.05$).

Discussion

Periodontitis is localized to the immediate surroundings of the periodontal pocket; thus, it represents the ideal natural site for research related to antimicrobial treatment with local delivery systems. The local application represents less chance of developing bacterial resistance, fewer adverse effects, and better compliance than with the use of systemic antimicrobials. It is usually suggested in patients with non-responding and recurrent localized pockets because much higher concentration can be attained by limiting the drug to its target site.⁷ In this contemporary time, a search for naturotherapies is on the rise due to various side effects of allopathic medications used for periodontal disease.⁸

A. vera that belongs to the Liliaceae family is a cactus plant and is gaining popularity as a naturotherapy in various medical and cosmetic products. Leaf of *A. vera* plant consists of the central mucilaginous part and peripheral bundle sheath cells. This central mucilaginous part is made up of parenchymal tissue and produces a clear, thin, tasteless jelly-like material called *A. vera* gel,⁹ which is known for its anti-inflammatory and antiseptic properties.¹⁰

As earlier studies had been carried out independently on metronidazole and *A. vera*, respectively, as an adjunct to SRP and had shown beneficial effects in improving periodontal health, however, relative studies comparing their efficacy on clinical parameters have not been reported. Contemplating this, the present study was undertaken to compare the improvement in clinical parameters by evaluating the efficacy of *A. vera* to metronidazole, as an adjunct to SRP in patients with chronic periodontitis patients with chronic periodontitis. All the subjects enrolled for the present study showed statistically significant improvements in clinical parameters at the time interval of 30, 60, and 90 days compared to those at baseline. Both *A. vera* and metronidazole groups in adjunct to SRP showed statistically significant improvement as compared to SRP alone.

Bhat *et al.*⁹ carried out a study to evaluate the effect of intra-pocket placement of *A. vera* gel after SRP and concluded that subgingival administration of *A. vera* gel results in improvement of periodontal condition. Viridi *et al.*¹¹ also demonstrated that SRP and *A. vera* showed better SRP alone. Similarly, studies carried out by Ajmera *et al.*¹² and Chandras has *et al.*¹⁰ revealed the role of *A. vera* in a significant reduction of plaque and gingivitis. The role of *A. vera* in improving clinical parameters is attributed to its anti-inflammatory¹⁰ and antibacterial properties.¹³ It readily reduce the gingival inflammation and pain associated with it.¹⁴ *A. vera* is rich in Vitamins A, C, E, and B1 (thiamine), niacin, B2 (riboflavin), choline, folic acid,

traces of Vitamin B12, and enzymes such as acid phosphatase, alkaline phosphatase, amylase, lactic dehydrogenase and lipase,⁸ minerals, sugars, lignin, saponins, salicylic acids, and amino acids. Polysaccharides are considered to be the active ingredients of Aloe's anti-inflammation and immune-modulation effects.¹² The presence of sterols, anthraquinones, salicylic acid, lupeol, phenols, and sulfur also attributes to anti-inflammatory, antiseptic properties and also possess the capability to reduce prostaglandin synthesis from arachidonic acid, thus reducing inflammation.¹⁰ Anthraquinones possess antibacterial, antifungal, antiviral properties and produce analgesia like effect.¹¹ Hence, the reduction in plaque index can be attributed to antibacterial properties and reduction in gingival index scores can be attributed anti-inflammatory to properties of *A. vera*.

On the other side, among the various locally delivered chemotherapeutic agents metronidazole, has a bactericidal action against anaerobes such as *Prevotella intermedia*, *Porphyromonas gingivalis*, *Tannerella forsythia*, *Fusobacterium* species and spirochetes such as *Treponema denticola* and *Treponema vincentii*, which are generally believed to be the main pathogens associated with periodontitis.³ The results of the present study are similar to study carried out by Ainamo *et al.*,¹⁵ who compared the effect of metronidazole 25% gel in adjunct with subgingival scaling in adult periodontitis patients and revealed that both periodontal pocket depth and bleeding on probing were significantly reduced as compared to SRP alone. Similarly, Noyan *et al.*¹⁶ examined that local metronidazole in combination with SRP seems to be more effective in terms of producing both clinical and microbial improvements. Griffit *et al.*¹⁷ also concluded that SRP followed by application of metronidazole significantly improves clinical attachment level.

Comparing the three groups in their ability to reduce plaque and gingival scores, it was observed that reduction of plaque and gingival index by *A. vera* and metronidazole was comparable and showed similar improvement and was not significant which suggests that *A. vera*, a natural herb shows similar benefits as compared to chemotherapeutic agents metronidazole. Thus, the present study encourages the use of naturotherapy in the form of *A. vera* for the treatment of chronic periodontitis.

Conclusion

The results concluded that treatment with *A. vera* and metronidazole in adjunct to SRP improves clinical parameters in periodontitis patients as compared to SRP alone. As the results of both test groups are comparable, local application of *A. vera* can be an effective and affordable herbal substitute for metronidazole.

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