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Evaluation of the effect of locally delivered aloe vera gel as an adjunct to scaling and root planing in the treatment of chronic periodontitis - A split-mouth study

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Abstract

Background: Periodontal diseases are inflammatory in nature; the severity and clinical manifestation depend on the host-immune inflammatory response. This clinical study focuses on aloe vera gel and its effects when used as a local drug delivery (LDD) in the periodontal pocket after scaling and root planing.

Aim: To evaluate the clinical effect of sub-gingivally delivered aloe vera gel as an adjunct to scaling and root planing in the treatment of chronic localized moderate periodontitis at Group I (test site) as compared to Group II (test site).

Materials and method: Twenty-eight patients with chronic periodontitis having pocket probing depth (PPD) of 4-5mm and clinical attachment level (CAL) ≥ 3 mm in at least 2 to 3 subsequent teeth were included in the study. Sites were divided into 2 groups: on the test site (Group I), scaling & root planing plus aloe vera gel injected at baseline. On the control site (Group II), only scaling & root planning were done. clinical parameters such as Gingival index (GI), plaque index (PI), Modified sulcus bleeding index (MSBI), pocket probing depth (PPD), and clinical attachment level (CAL) were measured at baseline, 1 month, and 3 months.

Results: There was a significant improvement in the GI, PI, MSBI, PPD, and CAL scores at 1 month and 3 months in both groups (Mann Whitney U test). Whereas the test group showed statistically significant results as compared to the control ($p<0.001$*).

Conclusion: Results encourage the use of aloe vera gel with its high medicinal value, less toxic, and less expensive can be used as an adjunct to SRP in chronic moderate periodontitis patients.

Keywords: Aloe vera gel, scaling and root planing, local drug delivery,

Introduction

Periodontal disease is an inflammatory disease characterized by the destruction of the supporting structures of the teeth. The primary etiologic factor of periodontitis is dental plaque and the microorganisms that are present in it. The aim of periodontal therapy involves the removal of supra- and sub-gingival plaque and calculus, thereby returning the tissues to a state of health. Mechanical treatment alone may not be sufficient in some cases with deep periodontal pockets or in areas of furcation involvement. To overcome this, the addition of antimicrobials both systemically and locally would serve as adjuncts to mechanical therapy.[1]

Systemic antimicrobial agents may reduce or eliminate bacteria that cannot be removed by SRP. It involves a relatively high dose with repeated intake over a prolonged period of time to achieve the required inhibitory concentrations in the sulcular fluid. This increases the chances of the development of resistance by alteration of commensal flora.

Local drug delivery appears to be a suitable form to deliver drugs into a periodontal pocket. Local drug delivery agents such as tetracyclines including doxycycline and minocycline gel, metronidazole gel, chlorhexidine chips, and other drugs are commonly used. However, they have disadvantages, including hyper sensitivity reactions, phototoxicity, staining of teeth, and are relatively expensive.[2] So that, several herbal products and their elements are used as Local drug delivery to treat periodontitis.

Aloe-vera, Neem, Lemongrass, Curcumin, tulsi, green-tea are some of the herbal products that are popularly used as an adjunct to scaling and root planing. Among all these herbal products aloe vera is known to be extremely helpful in treating periodontal diseases. Its soothing and healing characteristics help to minimize gingival bleeding as well as swelling and soft tissue edema.

Aloe vera is available in various forms such as gel, mouthwash, dentifrice, and chip. The Gel form of aloe vera is used because the gel matrix is mucoadhesive and therefore is not easily washed away by the flushing action of the gingival fluid or saliva. Being its anti - inflammatory, immune - modulating, antioxidant, and immune-boosting properties for the present study aloe vera gel is used as an adjunct to scaling and root planning in the treatment of chronic periodontitis patients.[3]

Materials and method

A Randomized comparative clinical split-mouth study was conducted in the Department of Periodontics during the year 2020-2022, with the approval of the Institutional Ethical Committee and Gujarat University. The subjects belonged to the age range of 25-55 years with a sample size of 28 patients were divided into 2 groups: I) Group I (Test site): SRP followed by intrasulcular placement of aloe vera gel in the sites with 4-5mm PPD and ≥ 3 mm CAL (63 sites). II) Group II (control site): only scaling & root planning (63 sites). The patients selected were subjected to assessment of clinical parameters which included Plaque Index (PI), Gingival Index (GI) Probing pocket depth (PPD) and Clinical attachment level (CAL) were measured at baseline, 1 month and 3 months. As an inclusion criterion for the study, all patients with PPD of 4-5mm or CAL ≥ 3 mm in at least 2 to 3 subsequent teeth were

selected and no previous periodontal surgical treatment and antibiotic therapy within 6 months. Exclusion criteria were history of any drug allergy**,** Smokers, alcoholic**,** and medically compromised patients. (Diabetes mellitus, cardiovascular disorder, thyroid disorder, coagulation disorder, autoimmune disease, etc.

Aloe vera gel preparation

The Aloe vera gel was prepared at L.M. college of pharmacy, Ahmedabad by using an aloe vera abstract herbal viscous solution of 100ml dissolved in a gelling agent (Carbopol 934- q.s.1%). Sodium methylparaben as a preservative (1%) and sodium benzoate as an antioxidant (1%) was added to the gel.

After the collection of data, the data were coded and entered in Micro-soft Excel 2019. Statistical Package for Social Sciences (SPSS version 22, IBM cooperation, Armonk, NY) was used for statistical analysis. The descriptive analysis was done for mean, standard deviation and median. Intragroup comparison according to time interval was made by using the Friedman test. If the result shows a significant difference post hoc test was done by using the Wilcoxon test. Mann Whitney U test was applied to compare the scores between two groups. The level of significance was kept at 5%.

Result

Statistical analysis showed a statistically significant difference between GI, PI, MSBI, PPD and CAL gain of case and control groups at 1 month and 3 months after gel placement on the periodontal pocket. The change in mean PI between the group was analyzed using Mann Whitney U test. In the present study, for Group I mean PI was 2.19 ± 0.25 at baseline, 1.06 ± 0.11 at 1 month and 0.82 ± 0.09 at 3 months. The mean PI in Group II was 2.17 ± 0.24 at baseline, 1.68 ± 0.26 at 1 month and 1.71 ± 0.31 at 3 months. On intergroup comparison at baseline ($p=0.82$) was non-significant whereas it was significant at 1 month ($p<0.001$) and 3 months($p<0.001$), scores were statistically significant at 1 month and 3 months which demonstrates that both the treatment modalities resulted in a reduction of the PI scores of the patients but more reduction of PI score in Group-I. (Table-1).

Statistical analysis showed that the change in mean GI for Group-1 was 2.14 ± 0.16 at baseline, 0.94 ± 0.09 at 1 month and 0.28 ± 0.08 at 3 months. The mean GI in Group II was 2.11 ± 0.18 at baseline, 1.71 ± 0.19 at 1 month and 1.42 ± 0.23 at 3 months. On inter group comparison at baseline ($p=0.41$), 1 month ($p<0.001$) and 3 months ($p<0.001$), scores were statistically significant at 1 month and 3 months in both groups but more reduction of GI score in Group-1 (Table-2).

The change in mean MBSI in Group I was 2.04 ± 0.05 at baseline, 0.86 ± 0.11 at 1 month and 0.26 ± 0.09 at 3 months. The mean MSBI in Group II was .04 ± 0.07 at baseline, 1.66 ± 0.14 at 1 month and 1.55 ± 0.17 at 3 months. On intergroup comparison at baseline ($p=0.79$), 1 month ($p<0.001$) and 3 months ($p<0.001$), scores were statistically significant. This indicates that both the treatment procedures are equally effective in improving gingival health at 3 months. There was a greater improvement in Group I (SRP + aloe vera gel) in comparison to Group II (SRP) at the end of the study (Table-2).

The change in mean PPD in Group I was 5.43 ± 0.39 at baseline, 3.67 ± 0.23 at 1 month and 2.44 ± 0.25 at 3 months. The mean PPD for Group II was 5.38 ± 0.41 at baseline, 5.00 ± 0.40 at 1 month, and 4.70 ± 0.40 at 3 months. On intergroup comparison, the difference at baseline ($p=0.63$) was non-significant whereas it was significant at 1 month and 3 months. but more reduction of PPD scores in Group-1 (Table-4).

The change in mean CAL in Group I was 5.57 ± 0.41 at baseline, at 3.77 ± 0.25 at 1 month, and 2.57 ± 0.24 at 3 months. The mean CAL at Group II was 5.51 ± 0.39 at baseline at 5.16 ± 0.43 1 month and 4.83 ± 0.39 at 3 months. On intergroup comparison of CAL between baseline (p=0.52), 1 month (p<0.001), and 3 months (p<0.001) the difference was significant at 1 month and 3 months. but more reduction of CAL score in Group-1

Discussion

Periodontitis is caused due to a multi-factorial disturbance between bacterial biofilm and a susceptible host. Traditional treatment options for chronic periodontitis include mechanical debridement (scaling and root planing) to remove the sub gingival micro-organisms and provide clean, smooth, and compatible root surfaces. But, some limitation of mechanical therapy leads to the addition of antimicrobials both systemically and locally would serve as adjuncts to mechanical therapy. In the form of local drug delivery, various antimicrobials, antiseptics, and herbal products are used to treat periodontitis.

Aloe barbadensis Miller (Aloe vera) has anti-inflammatory, antioxidant, anti-microbial, healing-promoting, and immune-boosting properties.[3] Huggers and Robson et al. (1985)[5] showed that barbaloin and aloe-emodin in aloe vera block Prostaglandin (PG) synthesis and also decrease edema and the number of neutrophils and prevent migration of polymorphonuclear leukocytes. Barr antes and Guinea et al. (2003)[6] stated that aloe-vera inhibits the stimulated granulocyte matrix metallo proteinases inhibiting cyclo- and lipo-oxygenase pathways.

A total of 126 sites with a minimum of 4-5 mm probing depth in 30 patients were proposed for a Randomized clinical trial study. Out of the 30 selected patients, 2 patients did not turn in for a follow-up, hence they were excluded from the study. The clinical parameters such as PI, GI, MSBI, PPD, and CAL were recorded at baseline, 1st month and 3rd month to know whether the obtained results are maintained for a short period or not.

In the present study, there was a significant reduction in PI, score in Group I as compared to Group II from baseline to 1st month and 3rd month (p <0.001). These results are from the study conducted by Virdi et al. (2012)[7] showed that statically significant differences were found in PI at the baseline and after 6 weeks in the SRP-ALOE group (p < 0.001) compared to the SRP group (p < 0.1771). These results are not to the study conducted by Deepu S.L. et al. (2018)[8] showed that no statistically significant difference in PI in areas of aloe vera gel treatment combined with SRP (Test group) compared to the control group in 1st and 4th month. (p<0.19).

On intergroup comparison at baseline, 1 month and 3 months, GI, MSBI, PPD, and CAL scores were statistically significant at 1 month and 3 months in both groups but more reduction of GI score in Group-1 (p <0.001). Hagger et al. (1979)[9] showed Aloe vera has antibacterial properties against Streptococcus pyrogens, Streptococcus fecal is and Candida albicans. The reduction in gingival index observed in the present study could be explained by Ellis SD et al. (1998)[10], who found out that aloe vera gel contains biologically active compounds such as mannose-6- phosphate, carboxy peptidase, glutathione peroxidase, and super oxide dismutase. These compounds possess anti-inflammatory, antioxidant, and anti-bacterial properties.

Kudalkar MD et al. (2014)[11] evaluate the anti-inflammatory effect of Aloe vera by way of its inhibitory effect on MMP-2 and MMP-9 activity in cases of chronic periodontitis. Tissues treated with Aloe vera in the concentration of 2000 µg/ml showed a 20.09%

reduction in the MMP-2 and a 20.4% reduction in the MMP-9 activity.

Improvement of periodontitis is considered to be the result of aloe vera's effect on Matrix metalloproteinase (MMPs). Makela et al. (1994)[12] showed that two types of gelatinases, MMP-2, and MMP-9, were inhibited by aloe vera gel. Surekha Rathod et al (2015)[13] evaluate the effect of aloe vera and turmeric chips as an adjunct to SRP and showed that statistically significant CAL gain Aloe vera gel group as compared to the turmeric gel group at 3 months. ($p<0.001$).

From this clinical study, A. vera has the potential to manage chronic moderate periodontal disease, but longitudinal studies are needed to demonstrate the favourable effect of aloe vera gel application on clinical parameters.

Conclusion

The Present study infers that "Alovera as a potential herb", in gel form can be used to treat periodontal disease as an adjunct to SRP in chronic periodontitis patients with the advantages of being easily available, less toxic, and less expensive when compared to the chemical agents.

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Table 1: Comparison of change in Plaque index (PI) based on test and control groups.

PI	Groups	n	Mean ± SD	p Value[s]
Baseline	Group I	63	2.19 ± 0.25	0.82
	Group II	63	2.17 ± 0.24	
1 month	Group I	63	1.06 ± 0.11	<0.001**
	Group II	63	1.68 ± 0.26	
3 months	Group I	63	0.82 ± 0.09	<0.001**
	Group II	63	1.71 ± 0.31	

[a] Mann Whitney U test; SD: Standard deviation; **p<0.001 highly significant

Table 2: Intergroup comparison of the change in Gingival index (GI) at baseline, 1 month & 3 months

GI	Groups	n	Mean ± SD	p-Value
Baseline	Group I	63	2.14 ± 0.16	0.41
	Group II	63	2.11 ± 0.18	
1 month	Group I	63	0.94 ± 0.09	<0.001**
	Group II	63	1.71 ± 0.19	
3 months	Group I	63	0.28 ± 0.08	<0.001**
	Group II	63	1.42 ± 0.23	

[a] Mann Whitney U test; SD: Standard deviation, GI: Gingival index

Table 3: Intergroup comparison of Modified sulcus bleeding index (MSBI) at baseline, 1 month & 3 months.

MSBI	Groups	n	Mean ± SD	p-Values
Baseline	Group I	63	2.04 ± 0.05	0.79
	Group II	63	2.04 ± 0.07	
1 month	Group I	63	0.86 ± 0.11	<0.001**
	Group II	63	1.66 ± 0.14	
3 months	Group I	63	0.26 ± 0.09	<0.001**
	Group II	63	1.55 ± 0.17	

[a] Mann Whitney U test; SD: Standard deviation; MSBI: Modified sulcus bleeding index

Table 4: Intergroup comparison of probing pocket depth (PPD) at baseline, 1 month & 3 months.

PPD	Groups	n	Mean ± SD	p Value[s]
Baseline	Group I	63	5.43 ± 0.39	0.63
	Group II	63	5.38 ± 0.41	
1 month	Group I	63	3.67 ± 0.23	<0.001**
	Group II	63	5.00 ± 0.40	
3 months	Group I	63	2.44 ± 0.25	<0.001**
	Group II	63	4.70 ± 0.40	

[a] Mann Whitney U test; SD: Standard deviation; PPD: probing pocket depth.

Table 5: Intergroup comparison of clinical attachment level (CAL) at baseline, 1 month & 3 months.

CAL	Groups	n	Mean ± SD	p Value[s]
Baseline	Group I	63	5.57 ± 0.41	0.52
	Group II	63	5.51 ± 0.39	
1 month	Group I	63	3.77 ± 0.25	<0.001**
	Group II	63	5.16 ± 0.43	
3 months	Group I	63	2.57 ± 0.24	<0.001**
	Group II	63	4.83 ± 0.39	

[a] Mann Whitney U test; CAL: clinical attachment level **p<0.001 highly significant