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"Comparative Evaluation Of Clinical Efficacy Of Aloe Vera Chip As An Adjunct To Nonsurgical Therapy In The Treatment Of Chronic Periodontitis"

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ABSTRACT

BACKGROUND

Periodontitis is a chronic inflammatory disease that affects the supporting tissues of the teeth. Local drug delivery systems act as an effective adjunct to conventional SRP. For thousands of years, various herbal products have been used for chemotherapeutic purposes in the field of medicine and dentistry. Aloevera is one such medicinal, with anti-inflammatory, antioxidant, antibacterial, antiviral, antifungal, and immune boosting properties. The aim of the study was to evaluate the clinical effectiveness of locally delivered Aloevera chip as an adjunct to scaling and root planing and lasers in the treatment of patients with chronic periodontitis

METHODS AND FINDINGS

The split mouth study was carried out in a randomly selected subjects with chronic periodontitis having a pocket depth of ≥5mm and was categorized as follows: Group I: Scaling and root planing, Group II: Scaling and root planing + aloevera chip. Probing pocket depth, Clinical attachment Level and Gingival index in each patient was measured at baseline, 1 month and 3 months at the same sites.

The mean probing depth reduction, clinical attachment level (CAL) and gingival index were greater in the Aloevera group than in the scaling and root planing alone group at 1 and 3 months. Furthermore, a significantly greater mean percentage of was found in the aloevera group than in the scaling and root planing groups at 1 and 3 months.

CONCLUSION

Aloevera showed significant improvement in all clinical parameters, along with greater PPD reduction, compared to scaling and root planing in the treatment of chronic periodontitis patients as an adjunct to SRP.

INTRODUCTION

Periodontitis is a chronic inflammatory disease prevalent in most populations, and is characterized by inflamed gingiva and loss of connective tissue attachment between the tooth and its surrounding alveolar bone. Chronic bacterial exposure and host immune- inflammatory response is believed to play an important role in the destruction of connective tissue and bone, which are key features in the progression of periodontitis.

Periodontal treatment through the ages has focused on the reduction of bacterial infection by mechanical removal of infectious agents. Scaling and Root Planing (SRP) still remains the "gold standard"; however, it may fail to reduce or eliminate the anaerobic infection at the base of the pocket, at inaccessible areas such as the furcation, and within the gingival tissues and structures inaccessible to periodontal instrumentation such as sites with probing depths (PDs) >5mm.

Local drug delivery systems act as an effective adjunct to conventional SRP. It provides controlled release of therapeutic agents at specific subgingival sites, thus translating into high concentrations at the target site with reduced dosage, fewer side effects, fewer applications, and higher patient acceptance compared to systemic drugs.

For thousands of years, various herbal and natural products have been used for chemotherapeutic purposes in the field of medicine and dentistry, with the advantage of minimal side effects and cost-effectiveness. Aloevera is one such medicinal, a perennial succulent plant belonging to the Xanthorrhoeaceae family with anti-inflammatory, antioxidant, antibacterial, antiviral, antifungal, and immune boosting properties. It also promotes wound healing by accelerating epithelial cell migration and collagen maturation, facilitating tissue restoration.

It is member of tree Lily family known as Aloe barbadensis. Aloe barbadensis consists of two parts which differ completely in their composition and therapeutic properties. The parenchymal tissue makes up inner portion of the aloe leaves

and produce the aloe vera gel, a clear, thin, tasteless jelly like material. It also promotes wound healing by accelerating epithelial cell migration and collagen maturation, facilitating tissue restoration. Acemannan, a polysaccharide from aloe vera, has been found to have osteogenic properties. The use of this herbal product may serve to widen the treatment options for Chronic periodontitis.

There is limited literature available regarding the use of aloe vera in the form of chip as a local drug delivery system in dentistry. Hence, the present study is designed to evaluate the clinical effects of locally delivered AV chip and compare them with scaling and root planing in patients with Chronic Periodontitis.

AIM

The objective of this study was to compare and evaluate the clinical effects of SRP and aloevera chip; SRP and SRP along with locally delivered aloevera chip in chronic periodontitis patients at baseline and 3 months' post therapy.

MATERIALS AND METHODOLOGY

This randomized controlled split mouth clinical trial involved 15 healthy chronic periodontitis patients aged between 20 and 40 years, who visited the Department of Periodontology, Rajarajeswari Dental College and Hospital, Bangalore; between September 2019 and January 2020. An approval was obtained from the Institutional Ethical Committee (RRDCHET/05PERIO/2019).

The participants were selected based on the following inclusion criteria:

1. Chronic periodontitis patients with a pocket depth ≥5mm.

2. Systemically healthy patients

Exclusion criteria were:

1. Smokers and alcoholic patients.

2. Patients allergic to herbal medications.

3. Aggressive periodontitis patients.

4. Subjects on any medication taken within the last 6 months which may alter the

periodontal status.

5. Pregnant and lactating mothers.

6. Patients who have undergone periodontal treatment within a period of one year.

All the participants will be explained about the need and design of the study. Written informed consent for the study will be obtained from each patient.

Randomization and treatment groups

This randomized split mouth clinical study was carried out on randomly selected male and female subjects in the age group of 20-40 years with chronic periodontitis having a pocket depth of ≥ 5mm and was categorized as follows:

Group I: Scaling and root planing alone

Group II: Scaling and root planing + aloe vera chip.

Clinical examination to assess the periodontal condition

Clinical examination was performed on all teeth at baseline,1 month and 3 months. Clinical parameters, such as Gingival index (GI) (Loe H & Silness P, 1963), Probing Pocket Depth (PPD) and Clinical Attachment Level(CAL) were recorded.

GI was assessed using a mouth mirror and a probe. PPD was measured using the Williams graduated periodontal probe from the gingival margin to the base of the pocket. The measurements were made to the nearest mm at 6 surfaces (disto-buccal, disto-lingual, midbuccal, mesio-buccal, mesio-lingual, midlingual) of all teeth present. Clinical attachment level will be determined from a fixed landmark on individually fabricated stents using a William's periodontal probe. The precise assessment and comparison of the clinical attachment level at different intervals of time can determine whether the attachment is being lost, which indicates that the lesion is active. The exact measurement of this important clinical parameter was done from the CEJ to the bottom of the pocket and therefore requires that the location of this landmark be determined exactly and reproducibly.

Treatment procedures

In all selected patients, a full mouth ultrasonic scaling and root planing was in a single visit. At the start of the study, oral hygiene instructions were given and clinical parameters namely Gingival Index (GI), probing pocket depth (PPD) and clinical attachment level (CAL) were recorded in all the patients. Root planing was done with area specific curettes in all the groups along with ultrasonic scaling. Group II received aloe vera chip following SRP. Instructions for optimal oral hygiene was reinforced during each postoperative visit at baseline, 1 month and 3 months. No additional therapy was performed during these visits.

Formulation of aloe vera chip

Ingredients are as follows:

Aloe vera- 5%

Hydroxy Propyl Methyl Cellulose- 600mg

Hydroxy Propyl Cellulose- 100mg

Polyethylene Glycol- 50mg

Water- 10ml

10ml of water in a 100ml glass beaker was taken and kept on a Magnetic Stirrer. Temperature was set to 0 C. A magnetic bead was added into the glass beaker and RPM was set to 500. Required quantity of ingredients were weighed. While stirring, Hydroxy Propyl Methyl Cellulose was added in smaller quantities

and RPM was increased to 1000. After addition of Hydroxy Propyl Methyl Cellulose, Hydroxy Propyl Cellulose and Polyethylene Glycol was added. Stirring was continued for 2 to 3 hours at an RPM of 1000 to 1500. Further, Aloe vera was added and stirring was continued. Entire glass beaker contents were transferred to a petri-dish pre coated with glycerine and kept for drying at normal room temperature.

RESULTS

The descriptive statistics, including mean, minimum and maximum values, of the demographic variables of Group 1 and Group 2 are listed in Table 1 and Table 2. The age of subjects selected for the study ranged from 20 to 40 years with a mean age of 29.47 years (Table 1).

	N	Minimum	Maximum	Mean	Std. Deviation
Age	15	20	40	29.47	7.08

TABLE 1: MEAN AGE DISTRIBUTION OF THE SUBJECTS

There were a total of 15 participants with 7 females and 8 males in the study. (Table 2).

Gender	Frequency	Percent
Females	7	46.7
Males	8	53.3
Total	15	100

TABLE 2: GENDER-WISE DISTRIBUTION OF THE SUBJECTS

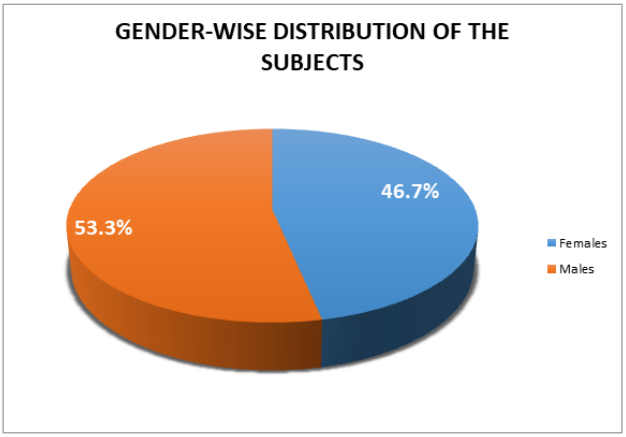

Table 3 describes the mean distribution of GI, PPD and CAL at baseline, 1 month and 3 months. In Group 1 and Group 2, mean baseline GI was 1.67 which was reduced to 1.16 at 1 month and gradually reduced to 1.05 at 3 months. In Group 1, mean PPD and CAL at baseline was 7 which was reduced to 6 at 1 month and 3 months whereas in Group 2, mean baseline PPD and CAL was 7 which was reduced to 6 at 1 month and gradually reduced to 5 at 3 months.

Groups	Time intervals	Clinical Para	N	Minimum	Maximum	Mean	S.D
		meters					
Group 1	**Baseline**	GI	15	1.1	2	1.67	0.25
		PPD	15	5	7	5.67	0.62
		CAL	15	5	7	5.67	0.62
	1 month	GI	15	0.7	1.6	1.16	0.24
		PPD	15	4	6	5.33	0.62
		CAL	15	4	6	5.33	0.62
	3 months	GI	15	0.7	1.4	1.05	0.21
		PPD	15	4	6	5.2	0.56
		CAL	15	4	6	5.2	0.56
Group 2	**Baseline**	GI	15	1.1	2	1.67	0.25
		PPD	15	5	7	5.87	0.64
		CAL	15	5	7	5.87	0.64
	1 month	GI	15	0.7	1.6	1.16	0.24
		PPD	15	2	6	3.73	1.1
		CAL	15	2	6	3.73	1.1
	3 months	GI	15	0.7	1.4	1.05	0.21
		PPD	15	2	5	3.53	0.83
		CAL	15	2	5	3.53	0.83

TABLE 3: MEAN DISTRIBUTION OF GI, PPD AND CAL AT BASELINE, 1 MONTH AND 3 MONTHS

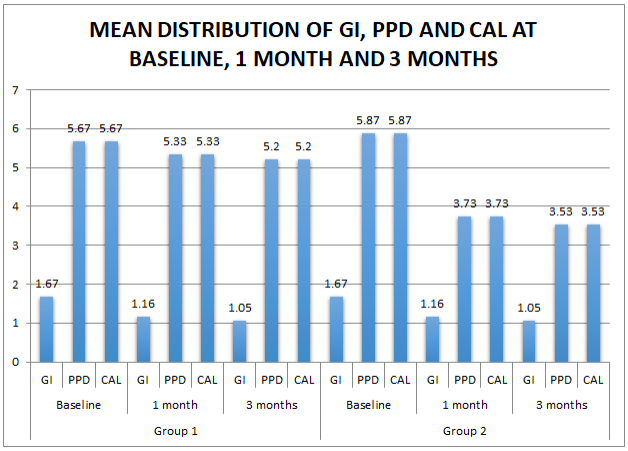

Table 4 describes comparison of GI, PPD and CAL between the groups at different time intervals. At baseline, with respect to GI, there was no significant difference seen between the groups. There was no significant difference seen with respect to GI, PPD and CAL at baseline. At 1 month, there is a significant difference between PPD and CAL but there is no significant difference in GI between the groups. Greater reduction of PPD and CAL is seen in Group 2 at 3 months when compared to Group 1.

Time intervals	Clinical parameters	Groups	N	Mean	S.D	Mean diff	t value	p value

Baseline	GI	Group 1	15	1.67	0.25	0	0	1
		Group 2	15	1.67	0.25			
	PPD	Group 1	15	5.67	0.617	-0.2	-0.87	0.39
		Group 2	15	5.87	0.64			
	CAL	Group 1	15	5.67	0.617	-0.2	-0.87	0.39
		Group 2	15	5.87	0.64			
1 Month	GI	Group 1	15	1.16	0.235	0	0	1
		Group 2	15	1.16	0.235			
	PPD	Group 1	15	5.33	0.617	1.6	4.91	0.00*
		Group 2	15	3.73	1.1			
	CAL	Group 1	15	5.33	0.617	1.6	4.91	0.00*
		Group 2	15	3.73	1.1			
3 Months	GI	Group 1	15	1.05	0.213	0	0	1
		Group 2	15	1.05	0.213			
	PPD	Group 1	15	5.2	0.561	1.66	6.42	0.00*
		Group 2	15	3.53	0.834			
	CAL	Group 1	15	5.2	0.561	1.66	6.42	0.00*
		Group 2	15	3.53	0.834			

TABLE 4: COMPARISON OF THE GROUPS AT DIFFERENT TIME INTERVALS USING INDEPENDENT SAMPLE T TEST

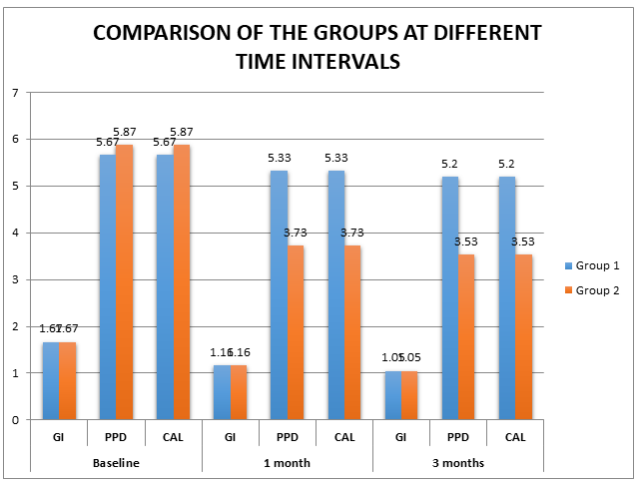

Table 5 describes comparison of the clinical parameters within the group among different time intervals. There was a significant difference in GI, PPD and CAL within the groups for both the groups.

Clinical Parameters	Groups	Repeated measures value	p value
GI	Group 1	102.5	0.00*
	Group 2	102.5	0.00*
PPD	Group 1	8.27	0.003*
	Group 2	108.26	0.00*
CAL	Group 1	8.27	0.003*
	Group 2	108.26	0.00*

TABLE 5: COMPARISON OF THE CLINICAL PARAMETERS WITHIN THE GROUP AMONG DIFFERENT TIME INTERVALS USING REPEATED MEASURES ANOVA

There was a significant difference seen from baseline to 1 month and 3 months with respect to GI in group 1 and group 2. But, from 1 month to 3 months there was no significant difference with respect to GI in group 1. From baseline to 1 month and baseline to 3 months, there was a significant difference in PPD and CAL in Group 2 and no significant difference seen with respect to PPD from 1 month to 3 months in Group 2. Conversely there was no significant difference in PPD and CAL at baseline to 1 month and 1 month to 3 months. But there was a significant difference with respect to PPD and CAL at baseline to 3 months in both Group 1 and Group 2. (Table 6)

Clinical parameters	Time intervals	Group 1		Group 2	
		Mean Difference	p value	Mean Difference	p value
GI	Baseline Vs 1 month	0.513	.000*	0.513	.000*
	Baseline Vs 3 months	0.62	.000*	0.62	.000*
	1 month Vs 3 months	0.107	.037*	0.107	.037*
PPD	Baseline Vs 1 month	0.333	0.058	2.133	.000*
	Baseline Vs 3 months	0.467	.011*	2.333	.000*
	1 month Vs 3 months	0.133	0.493	0.2	0.247
CAL	Baseline Vs 1 month	0.333	0.058	2.133	.000*
	Baseline Vs 3 months	0.467	.011*	2.333	.000*

	1 month Vs 3 months	0.133	0.493	0.2	0.247

TABLE 6: POST HOC BONFERRONI

Table 7 shows mean percentage reduction within the groups. There is mean percentage reduction in both the groups. With respect to GI, there is -30.84% reduction from baseline to 1 month and -8. 44% from 1 month to 3 months in both Group 1 and Group 2. With respect to both PPD and CAL, there is -5.62% reduction from baseline to 1 month and -2.22% from 1 month to 3 months in Group 1 whereas in Group 2 there is mean percentage reduction of -36.86% from baseline to 1 month and -3.78% from 1 month to 3 months.

Groups	Clinical parameters	Time intervals	N	Minimum reduction (%)	Maximum reduction (%)	Mean (%)	S.D (%)
Group 1	GI	Baseline to 1 month	15	-16.67	-43.75	-30.84	7.9
		Baseline to 3 months	15	0	-20	-5.62	8.3
		1 month to 3 months	15	0	-33.33	-8.44	11.14
	PPD	Baseline to 1 month	15	0	-20	-5.62	8.3
		Baseline to 3 months	15	0	-20	-7.84	8.75
		1 month to 3 months	15	0	-16.67	-2.22	5.86
	CAL	Baseline to 1 month	15	0	-20	-5.62	8.3
		Baseline to 3 months	15	0	-20	-7.84	8.75
		1 month to 3 months	15	0	-16.67	-2.22	5.86
Group 2	GI	Baseline to 1 month	15	-16.67	-43.75	-30.84	7.9
		Baseline to 3 months	15	-14.29	-60	-36.86	14.93
		1 month to 3 months	15	0	-33.33	-8.44	11.14
	PPD	Baseline to 1 month	15	-14.29	-60	-36.86	14.93
		Baseline to 3 months	15	-16.67	-60	-39.87	12.29
		1 month to 3 months	15	0	-20	-3.78	7.85
	CAL	Baseline to 1 month	15	-14.29	-60	-36.86	14.93
		Baseline to 3 months	15	-16.67	-60	-39.87	12.29
		1 month to 3 months	15	0	-20	-3.78	7.85

TABLE 7: MEAN PERCENTAGE REDUCTION OR INCREASE WITHIN THE GROUPS

DISCUSSION

Periodontal disease is an inflammatory disease of the periodontium usually caused by pathogenic microflora in the biofilm or dental plaque that forms on the tooth surfaces. Treatment of periodontal diseases by different types of local delivery systems has been investigated. Mouthwashes and irrigating agents such as Chlorhexidine, sodium hypochlorite, cetylpyridinium chloride and amine fluoride are widely used that can inhibit the development of potentially pathogenic bacteria.

Although these antimicrobial agents are widely used, immediate hypersensitivity reactions, toxicity, tooth staining and other side effects have been reported. Moreover, it has been reported that chlorhexidine on long term usage and sodium hypochlorite are cytotoxic to human periodontal ligament cells,

inhibit protein synthesis, and affect mitochondrial activity, thus having detrimental effects on vital tissues.

The natural phytochemicals isolated from medicinal plants used in traditional medicine have been considered useful alternatives to synthetic drugs. Many medicinal plants and their products are widely used for prevention and treatment of oral diseases, and among them Aloe vera is of particular interest and has been used therapeutically for a long time.

Aloe vera is a natural product contained in herbal dentifrices with commercial appeal on the control of plaque and gingivitis. Aloe latex contains anthraquinones, and enzymes bradykinase, which are chemical compounds that are used in healing and arresting pain because they are antiinflammatory in nature. Aloe vera inhibits the cyclooxygenase pathway and reduces prostaglandin E2 production from arachidonic acid. Also, Aloe vera contains 6 antiseptic agents: Lupeol, salicylic acid, urea nitrogen, cinnamonic acid, phenol and sulfur. They all have inhibitory action on fungi, bacteria and viruses.

In the present study, the clinical efficacy of AV chip for the treatment of chronic periodontitis with a pocket depth of 5-6mm was evaluated as an adjunct to SRP. There was a significant improvement in the clinical parameters in both the groups, which can be attributed to the elimination of local etiological factors through mechanical debridement.

The present study considers local drug delivery of aloevera chip in the periodontal pockets of patients with CP because it offers advantages of high concentrations at the target site with a reduced dosage compared to a systemic regimen. LDD could offer important benefits in terms of adverse reactions and patient compliance.

The present study found a significant reduction in mean PPD and gain in clinical attachment level (CAL), in alovera group, which can be attributed to antibacterial and anti- inflammatory properties.

Oliveria et al (2008) also reported significant reduction in plaque and gingivitis with use of dentrifice containing Aloe vera. Dilip et al demonstrated that Aloe vera was as effective against Candida albicans, Streptococcus mutans, Lactobacillus acidophillus, Entrococcus fecalis, Provetella intermedia and Peptostreptococcus anaerobius.

Aloevera has strong immunomodulatory activity wherein it downregulates lipopolysaccharide- induced inflammatory cytokine production and the expression of inflammasome in human macrophages.

Aloevera also accelerates collagen synthesis and promotes wound healing, which can account for the significant PD reduction and CAL gain. The findings of this study correlated with those of Pradeep et al. and Abdelmonem et al. Acemannan, a major component of AV, showed significantly- accelerated new alveolar bone and cementum and periodontal ligament formation in class II furcation defects.

The mean reduction in GI, PPD and the mean CAL gain were significantly greater in the Aloevera group at 1 to 3months interval, suggesting long- term benefits of this local delivery system. These findings are in commensurate with those of Abdelmonem et al., who found AV LDD as an adjunct to mechanical periodontal therapy to be associated with significant improvement in microbiologic as well as clinical outcomes in patients with CP.

Considering these facts, local drug delivery of aloevera chip as an adjunct to SRP can be proposed as a better approach for treatment of periodontal pockets in chronic periodontitis patients.

CONCLUSION

Under the experimental conditions, this clinical trial demonstrated that Aloe vera chip in the form of local drug delivery ensued a significant pocket depth reduction and clinical attachment level gain compared to scaling and root planing in chronic periodontitis patients. The results of the present study suggested that the local drug delivery of Aloe vera chip improved the periodontal status. However long term, multicentre randomized, controlled clinical trials are required to know its clinical histologic effect on periodontal tissues in patients with chronic periodontitis.

COMPETING AND CONFLICTING INTERESTS: No conflicts of interest

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