

# The Comparison of the Antiplaque Effect of Aloe Vera, Chlorhexidine and Placebo Mouth Washes on Gingivitis Patients

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## Abstract

### Background:

With the increasing incidence of periodontal diseases and development of antibiotic resistance, the global need for alternative treatment modalities, safe, effective, and economical products is the need of time. Aloe vera is a medicinal plant which has the greater medicinal value and enormous properties for curing and preventing oral diseases disease.

### Aim:

The aim of the study was to access the effect of Aloe vera chlorhexidine mouthwash as an adjunct to SRP

Material and methods: 90 healthy subjects were randomly allocated in 3 groups to the test group (n=30) – mouthwash containing Aloe vera, Control group (n=30) –chlorhexidine group, normal saline - Placebo (n=30). Plaque Index (PI) and Gingival Index (GI) were assessed at days 0, 15 and 30. Subjects were asked to rinse their mouth with the stated mouthwash, twice a day, during a 30-day period.

### Results:

Our result showed that Aloe vera mouthrinse is equally effective in reducing periodontal indices as Chlorhexidine. The results demonstrated a significant reduction of gingival bleeding and plaque indices in both groups over a period of 15 and 30 days as compared to placebo group. There was a significant reduction on plaque and gingivitis in Aloe vera and chlorhexidine groups and no statistically significant difference was observed among them ( $p>0.05$ ). Aloe vera mouthwash showed no side effects as seen with chlorhexidine.

### Conclusion:

The results of the present study indicate that Aloe vera may prove to be an effective mouthwash owing to its ability in reducing periodontal indices.

**Key Words:** Dental Plaque, Gingivitis, Aloe vera, Chlorhexidine, Gingival Index, Plaque Index.

## INTRODUCTION

Periodontitis are defined as an inflammatory disease of the supporting tissues of the teeth caused by specific microorganisms resulting in progressive destruction of periodontal ligament and alveolar bone loss with pocket formation, recession or both[1].

Periodontal diseases are initiated and sustained by microbial plaque that accumulates in gingival crevicular region and induces an inflammatory response [2]. This inflammation may progress in many individuals to the chronic destructive inflammatory condition termed periodontitis [3]. Although microbial, environmental, behavioral and systemic disease factors are reported to influence risk for moderate to severe periodontitis, there are strong evidences to support the host immune responses to the microbial challenge, are also associated with different clinical forms of periodontitis [4].

Gingivitis occurs before periodontitis. Gingivitis usually refers to gingival inflammation while periodontitis refers to gingival disease and the destruction of tissue and/or bone. Initially, with gingivitis, bacteria plaque accumulates on the surface of the tooth as biofilms, causing the gingiva to go red and inflamed; teeth may bleed when brushing them. Even though the gingival is irritated and bothersome, the teeth are not loose. There is no irreversible damage to bone or surrounding tissue.

The prevalence of periodontitis in developed countries was about 48% among the age group between 18 and 55 years

of old patients [5]. In India, there appears to be an increase in the prevalence of periodontitis figures varying from 50-79%.

The prevalence of gingivitis in developed countries was about 63% among the age group between 18 and 55 years of old. This rate raises with increasing in age [5]. In India, there appears to be an increase in the prevalence of gingivitis figures varying from 50-99%. The prevalence of gingivitis is less in girls than boys, which is probably related the levels of oral hygiene [5].

Gingivitis are caused by the substances derived from microbial plaque accumulating at or near the gingival sulcus ;all other suspected local and systemic etiologic factors either enhances plaque accumulation or retention , or enhance the susceptibility of the gingival tissue to microbial attack. .

Dental plaque is defined clinically as a structured, resilient, yellow-grayish substance that adheres tenaciously to the intraoral hard surfaces, including removable and fixed prosthesis [1].The plaque as a potential factor in development of periodontal diseases.

Plaque control: The concept of plaque control is broadly based on factors of mechanical plaque control and chemical plaque control. The mechanical plaque control is mainly achieved through tooth brushing either using a manual brush or using a motorized tooth brush or with the help of pressurized water pump system involving the use of water under pressure pumped through fine blunt needle or nozzle.

The chemical control of plaque includes organic or inorganic chemicals, which inhibit the accumulation, growth and survival of microbiota and debris. [4]

The golden standard adjunct used to control in the removal of plaque is chlorhexidine. But, it cannot be used for a long duration because it has many side-effects like altered taste sensation and staining of tongue[6]. Chemical plaque control agents are used as an adjuvant since they have the ability to inhibit growth and metabolism as well as colonization of bacteria; however, all are associated with various side effects [7]. Thus, patients are going away of modern day medicines, and they prefer using herbal preparations which are efficient without causing any side effects. Use of herbs for dental care is very common in indigenous system of medicine and herbs like Terminalia chebula, Aloe vera, Azadirachta indica, piper betle, Ocimum sanctum possess antibacterial, ulcer healing, antiplaque and anti halitosis properties [8].

The present study includes 100% Aloe vera extract which may be tested as one such oral hygiene aids to reduce plaque formation. It's a polysaccharide gel. Vast literature has mentioned its use worldwide like in Egypt, South Africa, India, China, Mexico and Japan for various ailments like burns, hair loss, skin infections, haemorrhoids, sinusitis, and gastrointestinal (GI) pain.[10] It was also a wound healer for bruises, X-ray burns, insect bites; and anti-helminthics, somatics, anti-arthritis.[11] Aloe vera has been used for various skin conditions, including radiodermatitis, frostbite, psoriasis and genital herpes infection.[12] Its pharmacological actions include anti-inflammatory, antibacterial, antioxidant, antiviral and antifungal actions [13].

Literatures are abundant on the health beneficial effects of Aloe vera but to date, no studies have been conducted to test its antiplaque efficacy. Hence, this study was conducted to compare the antiplaque effect of Aloe vera mouth wash, an adjunct to SRP ,against chlorhexidine and placebo.

#### MATERIALS AND METHODS

The study was conducted among the patients reported to the outpatient clinic of SAVEETHA DENTAL COLLEGE AND HOSPITALS, Chennai, Tamil Nadu

Study groups

The study was conducted among 90 patients who reported to the clinic. All the participants were screened for inclusion and exclusion criteria.

#### INCLUSION CRITERIA:

1. Patients aged between 18 to 70 years..
2. Presence of minimum 10 teeth.
3. Recording of plaque index.

#### EXCLUSION CRITERIA:

1. Patients had not done periodontal therapy in the last 6 months.
2. Current use of anti-inflammatory, antibiotics or antihistamines.
3. Teeth with evidence of pulpitis, carious lesions, defective restorations, cracked enamel.
4. Habits like smoking and alcohol drinking.
5. Patients who are having systemic diseases.

This study was approved by SRB and participants were explained about the study and informed consent was obtained. Patients were randomly divided into 3 groups

- Group A: Comprising of 30 patients who were instructed to use aloe vera mouth wash everyday as mouth wash
- Group B: Comprising of 30 patients who were instructed to use chlorhexidine mouth wash everyday for 30 days
- Group C: Comprising of 30 patients who were asked to use normal saline mouth wash for 30 days daily.

Clinical examination to assess plaque accumulation and gingivitis was done by a single trained and calibrated examiner. Plaque and gingivitis were assessed using modified Silness and Loe Plaque Index (William et al., 1991) and Gingival Index (Loe and Silness, 1963) at baseline and at follow-up after 15 days. After thorough examination for plaque and gingivitis, all the subjects underwent oral prophylaxis and received oral hygiene instructions along with 300 ml of mouth rinse. Subjects were instructed to rinse with 10 ml of mouth rinse for 1 min, twice daily. Patients were asked to report back to clinic for follow up on the 15<sup>th</sup> day and 30<sup>th</sup> day from the day data was collected. On 15<sup>th</sup> day and 30<sup>th</sup> day again gingival and plaque indices were recorded to compare it with baseline values on the first day.

Aloe vera drink commercially available, Noni juice, was diluted with water which is freshly prepared is given to the patients.

#### RESULTS

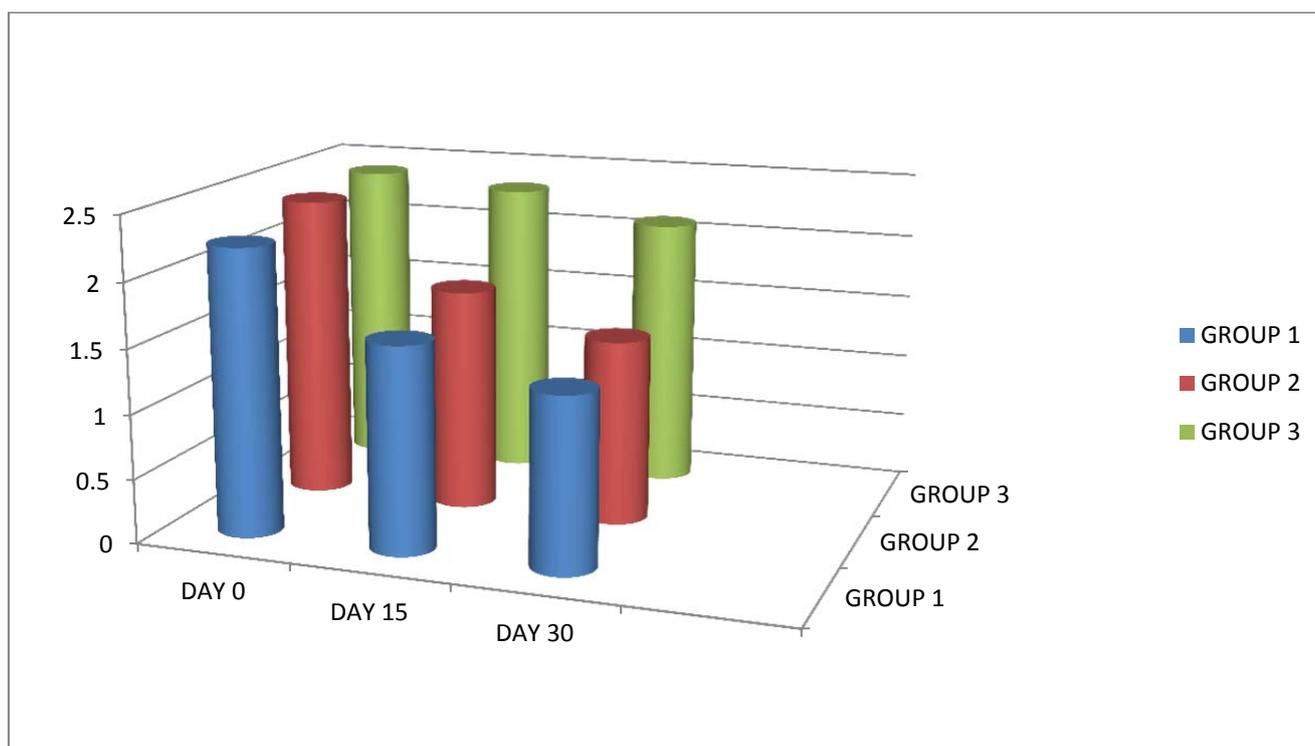
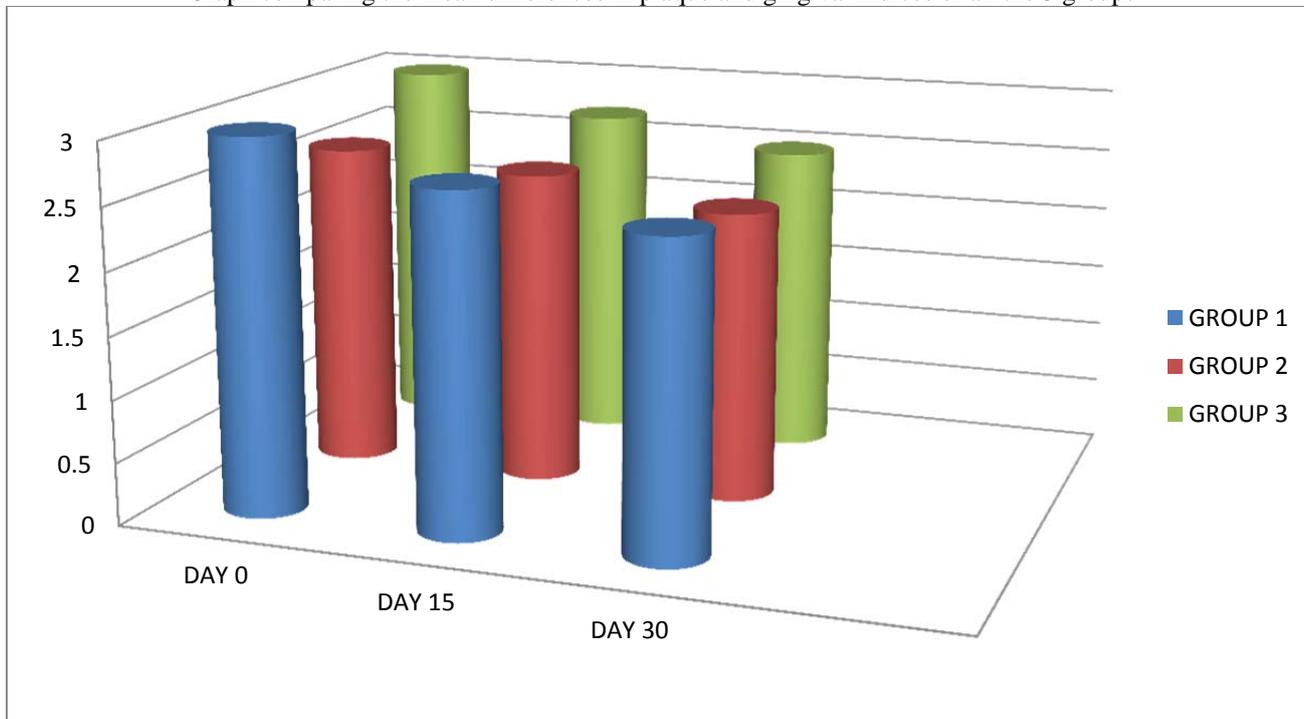
Mean scores of plaque and gingival index of 3 groups – aloe vera , chlorhexidine and normal saline

| PARAMETERS     | GROUP 1 |                      |                      | GROUP 2 |                      |                      | GROUP 3 |                      |                      |
|----------------|---------|----------------------|----------------------|---------|----------------------|----------------------|---------|----------------------|----------------------|
|                | DAY 0   | DAY 15 <sup>TH</sup> | DAY 30 <sup>TH</sup> | DAY 0   | DAY 15 <sup>TH</sup> | DAY 30 <sup>TH</sup> | DAY 0   | DAY 15 <sup>TH</sup> | DAY 30 <sup>TH</sup> |
| PLAQUE INDEX   | 3.00    | 2.71                 | 2.49                 | 2.61    | 2.31                 | 2.22                 | 3.00    | 2.17                 | 2.13                 |
| GINGIVAL INDEX | 2.23    | 1.60                 | 1.35                 | 2.36    | 1.73                 | 1.44                 | 2.40    | 2.38                 | 2.32                 |

Pre and post procedural percentage difference in using different mouthwashes- aloe vera , chlorhexidine and normal saline

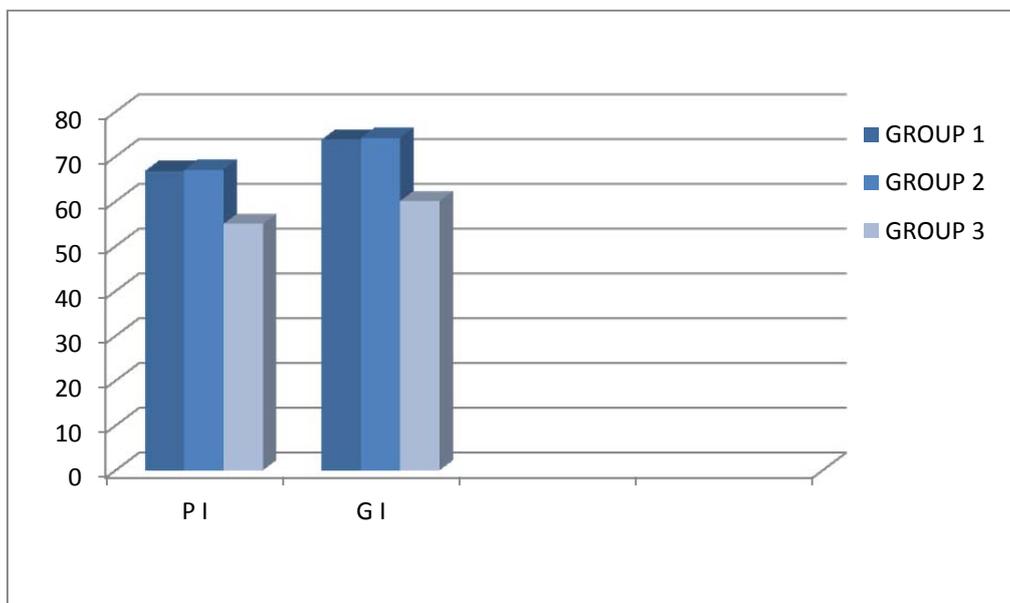
| PARAMETERS     | GROUP 1 | GROUP 2 | GROUP 3 |
|----------------|---------|---------|---------|
| PLAQUE INDEX   | 66.8%   | 67.1%   | 55.0%   |
| GINGIVAL INDEX | 73.8%   | 74.2%   | 60.1%   |

Graph comparing the mean differences in plaque and gingival indices of all the 3 groups



| Variable         | (I) Group     | (J) Group     | Std. Error | Sig.  |
|------------------|---------------|---------------|------------|-------|
| Plaque Baseline  | Aloe vera     | Chlorhexidine | .15892     | .042  |
|                  |               | Placebo       | .15892     | .022  |
|                  | Chlorhexidine | Placebo       | .15892     | .042  |
|                  |               | Aloe vera     | .15892     | .036  |
|                  | Placebo       | Aloe vera     | .15892     | .025  |
|                  |               | chlorhexidine | .15892     | .036  |
| Plaque (15 days) | Aloe vera     | Chlorhexidine | .15892     | 1.725 |
|                  |               | Placebo       | .15892     | .001  |
|                  | Chlorhexidine | Placebo       | .15892     | 1.725 |
|                  |               | Aloe vera     | .15892     | .001  |
|                  | Placebo       | Aloe vera     | .15892     | .001  |
|                  |               | Chlorhexidine | .15892     | .001  |
| Plaque (30 days) | Aloe vera     | Chlorhexidine | .15892     | 1.514 |
|                  |               | Placebo       | .15892     | .001  |
|                  | Chlorhexidine | Placebo       | .15892     | .001  |
|                  |               | Aloe vera     | .15892     | 1.514 |
|                  | Placebo       | Aloe vera     | .15892     | .001  |
|                  |               | Chlorhexidine | .15892     | .001  |

The mean percentage reduction of plaque index scores in Aloe vera, chlorhexidine, and normal saline groups was 20.38 ( $\pm 16.74$ ), 31.59 ( $\pm 16.58$ ), and 30.29 ( $\pm 18.30$ ), respectively. The mean percentage reduction of Gingival index scores in Aloe vera, chlorhexidine, and chlorine dioxide groups was 9.88 ( $\pm 8.77$ ), 16.30 ( $\pm 9.98$ ), and 12.22 ( $\pm 9.30$ ), respectively.



Graph comparing the pre and post procedural percentage- aloe vera , chlorhexidine and normal saline

The highest percentage reduction of plaque scores was found in chlorhexidine group (67%) followed by aloe vera group (66%) and normal saline group (55%). Similarly, the percentage reduction of gingival scores was maximum in chlorhexidine group (74%) followed by aloe vera group (73%) and normal saline group (60%) showed the least reduction

**DISCUSSION**

Dental plaque is the main etiological factor for periodontal disease. Plaque control are a critical component of dental practice, permitted long term success of periodontal and dental care. There are growing interest throughout the oral health care profession in therapeutic agents that compliment and enhance the mechanical removal of biofilms in the oral cavity. Various chemical methods of reducing plaque, such as mouth rinses, are used as they can provide significant benefits to patients who cannot maintain adequate mechanical plaque control [15].

Although mechanical plaque control can be an effective strategy for preventing the progression of periodontal diseases, most individuals do not adequately brush their teeth, and use a dental floss on a daily basis. The daily use of an effective mouth rinses are generally considered a

|                | F value | P value |
|----------------|---------|---------|
| Plaque index   | 0.737   | 0.482   |
| Gingival index | 5.297   | 0.007   |

P value of mean of plaque indices is 0.48 which is greater than 0.05 which shows its p value is not significant. P value is significant for gingival indices of which value is 0.007.

simple strategy and most patients can easily incorporate this into their home care routine.

Ainamo (1977) suggested that the use of chlorhexidine can be a motivational factor for patients [14]. It would make the patients aware of the sensation of cleanliness so they could make applications and develop their mechanical abilities for controlling plaque.

Chlorhexidine gluconate, a cationic bisbiguanide is the best known and widely used member of this class.[9] The antiplaque properties of chlorhexidine are unsurpassed by other agents. It has much greater and more prolonged effects than other antiseptics.[10] The digluconate of chlorhexidine (1: 6 – Di 4 – chlorphenyl – diguanidohexane) is a synthetic antimicrobial drug which is effective in vitro against both gram positive and gram negative bacteria including aerobes, anaerobes, yeast and fungi.[7]. So chlorhexidine is chosen as a golden standard always.

Various chemical mouthwashes are available in market but are associated with side effects like immediate hypersensitivity reactions, toxicity, tooth staining. Alternative medicines developed from medicinal plants can replace synthetic drugs and their potential side effects. Aloe vera mouthwashes are also cost-effective when compared to chlorhexidine gluconate mouthwash.

In recent times, there has been an increase in demand for alternative medicine[12]. Medicinal plants, such as Aloe vera, have natural phytochemicals and have proven to be better than synthetic drugs[13]. Studies by Khalessi *et al* [14] and Parwani *et al* [15] had suggested the better efficacy of herbal mouthwashes in maintaining plaque and gingival status. In vitro study on antimicrobial efficacy exposing supragingival plaque have found to have maximum effect at 100% concentration of Aloe vera [16]. In our study, 100% concentration of Aloe vera was used.

The main active ingredients in the Aloe vera gel was acemannan. It also contains aloin, aloemodin, aloemannan aloeride, naftoquinones, methylchromones, flavonoids, saponin, sterols, amino acids and vitamins in trace amounts.[9]. It's a polysaccharide gel. Aloe vera contains various anti-inflammatory agents such as carboxypeptidase, which reduce prostaglandin synthesis, magnesium lactate, which inhibits histidine decarboxylase preventing mast cell activity, sterols, and lupeol as pain modulators[16]. Aloe vera also reduces edema by inhibiting matrix metalloproteinases blocking polymorphonuclear leucocyte (PMNs) release, cyclooxygenase, and lipoxygenase pathways. These activated PMNs in turn inhibit free oxygen radicals[17]. These suggest potential anti-inflammatory action of Aloe vera, which showed a decrease in the GI [15]. Aloe vera has numerous anti-inflammatory agents. Carboxypeptidase in Aloe vera inactivates bradykinin by about 67% and relieves pain[13]. It's also stated that carboxypeptidase in Aloe vera had good anti-prostaglandin synthesis properties and compounds inhibiting oxidation of arachidonic acid, which decreased inflammation[16]. Aloe vera contains salicylate magnesium lactate decarboxylase, which is known to inhibit histidine, thereby preventing the formation of histamine from histidine in mast cells[17]. Barbolin and aloe emodin in

aloe vera block prostaglandin (PG) synthesis[11]. The decrease in gingival index can be attributed to presence of sterols as anti-inflammatory agents and lupeol as an antiseptic analgesic[11].

The study exhibited significant decrease in gingival and plaque indices at 15<sup>th</sup> day and 30<sup>th</sup> day, exhibiting good state of periodontium, which is in accordance with studies by Davis,[17] who stated that wound healing with Aloe vera was due to increased blood supply; increased oxygenation, which stimulates fibroblast activity; and collagen proliferation. Davis,[17] in vitro and in vivo studies showed healing with fibroblast proliferation. Wound healing by means of growth factors such as gibberellins, auxin and mannose phosphate, which bind to insulin-like growth factor receptor to improve healing, is also seen. Presence of glycoprotein with cell proliferation improves healing. Aloe vera also contains vitamins A, C, E, B<sub>12</sub>, folic acid. Vitamin C, which is involved in collagen synthesis, increases concentration of oxygen at the wound site because of dilation of blood vessels[9]. Aloe vera penetrates and dilates capillaries going to an injured site, which improves healing.

All the 3 groups have the ability to reduce the plaque and gingival scores but the reduction in scores varied. The highest percentage reduction of plaque scores was found in chlorhexidine group (67%) followed by aloe vera group (66%) and normal saline group (55%). Similarly, the percentage reduction of gingival scores was maximum in chlorhexidine group (74%) followed by aloe vera group (73%) and normal saline group (60%) showed the least reduction. According to the p values obtained, plaque index is not significant while gingival indices are significant which shows aloe vera is able to improve the condition of periodontium.

## CONCLUSION

In the present study, Aloe vera and chlorhexidine showed not much significant reductions in plaque, but the gingival scores showed a significant reduction when compared to normal saline over a period of 30 days. Hence, from the results of the study it can be concluded that aloe vera can be a suitable and economical alternative for chlorhexidine as it is easily available and is cheap with no side effects and minimal equipments. Herbal mouthwash containing Aloe vera mouthwash has comparable antiplaque efficacy as the chlorhexidine gluconate with fewer side effects and can be considered as an alternative. Only disadvantage of this study is that, the study was a short-term study with smaller sample size. Long-term studies are required with larger sample size and this study does not reveal about the antimicrobial count. Further studies should be carried out in knowing its antimicrobial effect for its better properties.

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