

## A Randomized Control Trial to Evaluate Efficacy of Anti-bacterial and Anti-inflammatory Effect of *Aloe vera*, Pomegranate and Chlorhexidine Gel against Periodontopathogens

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### Abstract:

**Background:** The anti-bacterial and anti-inflammatory effects of a gel *Aloe vera*, pomegranate and chlorhexidine (Chx) gel were evaluated for 7 days.

**Materials and Methods:** Forty subjects were included in the experiment. Test gels and placebo gels were used in this randomized trial. They were randomized into placebo, Chx, *A. vera* and pomegranate gel groups. On days 0 and 7, the plaque index and gingival index were recorded. Furthermore, the microscopic analysis to detect various organisms of the plaque was done pre and post application of gels.

**Results:** The results showed significant reduction in the quantitative bacterial levels in the pomegranate as well as Chx group. *A. vera* gel showed least reduction amongst all.

**Conclusion:** The gel containing *Punica granatum* extract was equally efficient in preventing plaque formation and gingivitis as compared to gold standard Chx gel.

**Key Words:** *Aloe vera* gel, chlorhexidine gel, gingivitis, pomegranate gel

### Introduction

Plaque control helps in the prevention of periodontal diseases<sup>1</sup> hence the main aim of a professional is to arrest the ongoing active disease. Plaque control can be carried with the help of either reducing the periodontopathogens or making microbes beneficial to tissues.

Mechanical and chemical agents are available for plaque control. Chlorhexidine (Chx) being used effectively for plaque control it is considered as a gold standard for chemical

plaque control. Apart from all the routinely used plaque control measures some alternative therapies such as herbal products for the treatment of inflammation and for reduction of the plaque bacteria have been tried.<sup>2</sup> Amongst them *Aloe vera* has been extensively used and has shown to significantly reduce gingivitis and plaque accumulation.<sup>3</sup> So, pomegranate and its products have been tested and proven to be effective against the plaque bacteria and some viruses.<sup>4</sup>

Pomegranate (*Punica granatum*) also has been used as a medicinal fruit extensively in many cultures.<sup>5</sup> The edible parts of the fruit are consumed or used in the preparation of fresh juices, canned food and also in the production of tooth paste<sup>6,7</sup> as well as in therapeutic formulas. Fruit methanol and peel extracts have a potent antimicrobial effect<sup>8-14</sup> *A. vera* is a cactus plant with some anti-inflammatory activity<sup>15-17</sup> antiulcer activity,<sup>18,19</sup> astringent effect, and enhancing wound healing<sup>20,21</sup> properties which are to be used to either reduce the plaque bacteria or to reduce the inflammation.

Studies have proven that *A. vera* gel as well as pomegranate has reduced the bacterial pathogenicity and also the inflammatory component.

Both these gels were compared with the gold standard of Chx gel, which has been proven clinically beneficial to reduce the plaque bacteria.

Hence, we compared the efficacy of anti-plaque and the anti-inflammatory activity of pomegranate, *A. vera* and Chx gel as compared to a control formulation in an experimental gingivitis model.

### Materials and Methods

This study was designed in the Department of Periodontics at ACPM Dental College, Dhule. The clinical and microbiological study was designed as a comparative evaluation of a group of patients over a period of 1-week in an experimental gingivitis model for 40 patients with chronic periodontitis. Informed consent was taken from the patient for undergoing the trial. The following inclusion and exclusion criteria were made.

### Inclusion criteria

- Patients within the age group of 30-40 years and with chronic periodontitis
- Patients without any history of systemic disease

- Patients should not have been under antibiotic coverage for last 6 months.

#### Exclusion criteria

- Antimicrobial therapy for patients at least 1-month prior to the study
- Individuals using mouthrinses or dentifrices or gel containing substances with anti-inflammatory properties and anti-plaque properties
- Individuals allergic to drugs or chemicals used in the study products
- Pregnant or lactating mothers
- Smokers.

Patients initially received thorough oral hygiene instructions. Scaling and root planning using hand and ultrasonic instruments was completed at the baseline visit. Forty patients were randomly divided into four groups with ten patients in each group:

Group 1 ( $n = 10$ ): Intra oral pomegranate gel application

Group 2 ( $n = 10$ ): Intra oral placebo gel

Group 3 ( $n = 10$ ): Intra oral *A. vera* gel application

Group 4 ( $n = 10$ ): Intra oral Chx gel application.

The pomegranate gel was prepared from drying the seeds of the fruit and then further processing it with the cellulose to make a gel formulation.

In the study, all the individuals were refrained from oral hygiene procedures for 7 days and plaque samples were collected from them. The following indices were recorded for the evaluation of the tissue condition.

- Gingival index (GI)
- Plaque index (PI)

The quantitative analysis of the bacteria was done by the collection of sub-gingival plaque sample and fixing it on the slide and measuring it in the field on the microscope. The qualitative analysis of the bacteria was done by culturing of the sub gingival plaque samples and evaluating them for *Porphyromonas gingivalis*, *Actinobacillus* species and *Prevotella intermedia*.

#### Results

For the quantitative analysis of mean quantitative analysis of bacteria as measured in the fields on the slide pre and post application of the gels intraorally at baseline and 7 days after the therapy (Table 1).

There was a significant reduction in the quantitative bacterial levels in the pomegranate as well as Chx group.

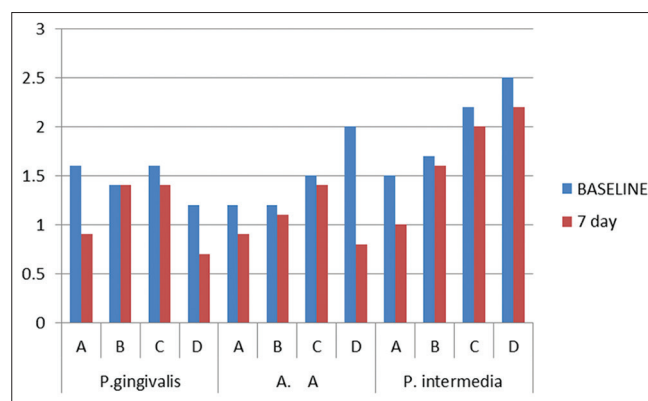
For the qualitative analysis of the bacteria *P. gingivalis*, *Aggregatibacter actinomycetemcomitans*, *P. intermedia* were found to be significantly reduced in the Group A and D as

compared to Group C and the placebo group showed minimal reductions (Graph 1, Table 2).

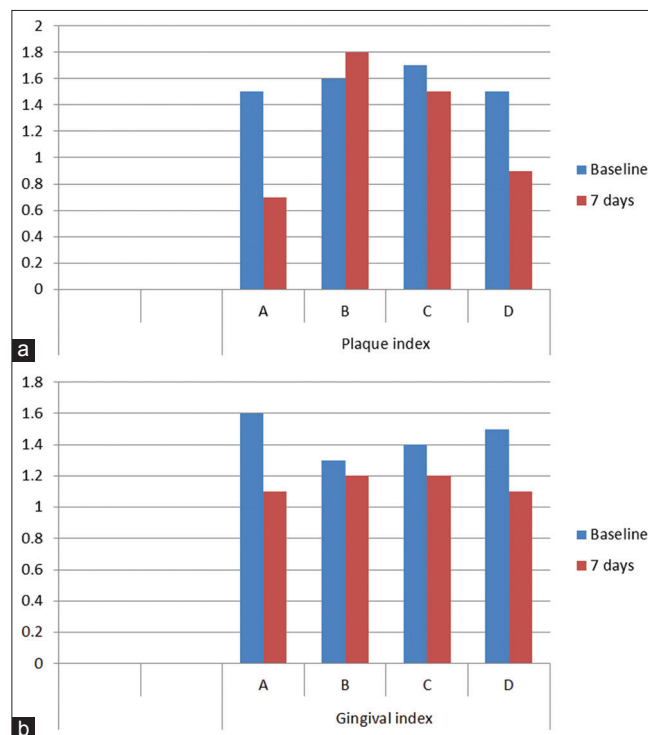
The GI and the PI for the Group A and D reduced significantly as compared to Group B and C, but the pomegranate group was nearby the values for reduction as compared to Chx group (Graph 2a and b, Table 3). Thus, the clinical manifestation of plaque accumulation and inflammatory activity was minimized more by Chx and pomegranate gel application.

#### Discussion

Though around 6000 plants in India are used in herbal medicines, little research has been conducted on efficacy, safety, and properties of herbal products. Over the decades, very few studies have been conducted to show the clinical



**Graph 1:** Preapplication and postapplication qualitative bacterial analysis.



**Graph 2:** Clinical indices at baseline and at 7<sup>th</sup> day. (a) Plaque index. (b) Gingival index.

Table 1: Bacterial count in fields of microscope for different groups.

Bacterial count in fields	1	2	3	4	5
Pre application					
Pomegranate (Group A)	+++ Bacilli	+	++	+	+++ Cocci
Placebo (Group B)	++++ Cocci	++++ Bacilli	++++ Bacilli	++++ Bacilli	+++ Filamentous
Aloe vera (Group C)	++++ Bacilli	++++	++++	+++ Bacilli +++ Cocci	+++ Bacilli
Chx gel (Group D)	++ Filamentous	+	-	+	++ Filamentous
Post application					
Pomegranate (Group A)	+ Bacilli	-	+	-	++ Cocci
Placebo (Group B)	+++ Cocci	++++ Bacilli	+++ Bacilli	++++ Bacilli	+++ Filamentous
Aloe vera (Group C)	+++ Bacilli	+++	+++	+++ Bacilli +++ Cocci	+++ Bacilli
Chx gel (Group D)	+ Filamentous	-	-	-	+ Filamentous

Table 2: Preapplication and postapplication qualitative bacterial analysis.

Name of bacteria	Groups	Bacteria count (*10 <sup>5</sup> )	
		Pre-operative	Post-operative
<i>P. gingivalis</i>	A	1.6	0.9
	B	1.4	1.4
	C	1.6	1.4
	D	1.2	0.7
<i>A. actinomycetemcomitans</i>	A	1.2	0.9
	B	1.2	1.1
	C	1.5	1.4
	D	2.0	0.8
<i>P. intermedia</i>	A	1.5	1.0
	B	1.7	1.6
	C	2.2	2.0
	D	2.5	2.2

*P. gingivalis*: Porphyromonas gingivalis, *A. actinomycetemcomitans*: Aggregatibacter actinomycetemcomitans, *P. intermedia*: Prevotella intermedia

Table 3: Clinical indices (plaque index and gingival index) at baseline and at 7<sup>th</sup> day.

Index	Group	Baseline	Post application 7 <sup>th</sup> day
Plaque index	A	1.5	0.7
	B	1.6	1.8
	C	1.7	1.5
	D	1.5	0.9
Gingival index	A	1.6	1.1
	B	1.3	1.2
	C	1.4	1.2
	D	1.5	1.1

efficacy of *P. granatum* and *A. vera*. In the present study, it was demonstrated that hydroalcoholic extract of pomegranate seed in the form of a gel exerted a significant reduction in clinical parameters as compared to Chx gel.

Evaluation of plaque scores showed that all the three groups except placebo showed reduction however, it was more significant in pomegranate gel group. These findings are contrary with the studies by Overholser *et al.*<sup>22</sup> and Haffajee *et al.*<sup>23</sup> where Chx showed a significant reduction. In a microbiological study, Menezes *et al.* (2006) showed that following 1-min mouth rinsing significant reduction in plaque was observed with *P. granatum* (84%) as compared to Chx (79%).<sup>24</sup>

Analysis of GI scores revealed that *P. granatum* was more efficient as compared to Chx gel and *A. vera* gel which may be due to its strong styptic action. Similar results were reported by Hafajee *et al.*<sup>23</sup>

A study by Salgado *et al.* in 2006 on 10% *P. granatum* gel does not support our finding where it was less helpful to control plaque and gingivitis.<sup>25</sup> Gel was placed into tooth shield in a non-diluted form; it may be speculated that gel solubilization with saliva would be necessary for its antimicrobial action to take place. May be direct interaction of saliva to *P. granatum* led to acceptable results in our study.

Despite its free commercial use, *A. vera* has limited anti-gingivitis and antiplaque action claims.<sup>26</sup> To the best of our knowledge, the present study is the first report about the effect of a gel containing *A. vera* and pomegranate on plaque and gingivitis. However, studies<sup>27</sup> have been conducted to check the efficiency of dentifrice containing *A. vera* on plaque and gingivitis wherein they showed reduced gingivitis.

Villalobos *et al.*<sup>2</sup> who observed reduction in plaque and gingivitis by use of *A. vera* mouthrinse is in accordance with this study.

In the present study, the concentration of *A. vera* used is 98 % which is much higher than another study,<sup>28</sup> which has 50% concentration and this could be the reason for the superior effect of this phytotherapeutic effect.

Qualitative analysis of the bacteria *P. gingivalis*, *A. actinomycetemcomitans*, *P. intermedia* were found to be significantly reduced in the Group A and D as compared to Group C and the placebo group showed minimal reductions. Plaque scores, gingival scores, quantitative, and qualitative analysis of microbes showed reduction in pomegranate gel group. Hence, it can be concluded that herbal products can also be used as antiplaque agents in order to overcome side effects associated with the use of Chx.

Oral health and related impact on quality of life is still controversial.<sup>28</sup> Risk factors might be many but to reduce risk

factors cannot directly cure the disease hence adjunct use of different agents on a large scale can prove to be useful.<sup>29,30</sup>

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