

# Efficacy of a *Eucalyptus* oil-based dentifrice in reducing plaque and gingival bleeding scores - A randomized clinical crossover study

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## ABSTRACT

Herbal products in dentistry have grown significantly. In the current scenario, herbal products are believed to be an effective adjunct to other medications. The present study aims to evaluate *Eucalyptus* oil and miswak (*Salvadora persica*) toothpaste for its efficacy in observable reduction in plaque and gingival bleeding. Sixty participants with gingivitis were enrolled in the present study. The study included an interim period (washout) comparing miswak and *Eucalyptus* toothpaste. Plaque scores were measured at designated time intervals. Both herbal toothpastes significantly decreased plaque index. Nevertheless, with relation to miswak ( $P = 0.002$ ), *Eucalyptus* oil-based toothpaste exhibited reduction in bleeding scores. When participants were asked to return to their routine toothpaste, no changes were observed. Results from the study showed that the toothpaste containing *Eucalyptus* showed a significant decrease in gingival bleeding. More investigations should be looked on the medicinal applications of *Eucalyptus* toothpaste on commonly seen periodontal parameters.

**Key words:** Dental related plaque, *Eucalyptus*, gingivitis, herbal toothpaste, miswak, *Salvadora persica*

## INTRODUCTION

Dental plaque accumulation results in gingival inflammation and other oral diseases.<sup>[1,2]</sup> Chronic gingivitis is the most prevalent form. Redness, soreness, swelling, a glossy surface, and bleeding distinguish gingivitis clinically.<sup>[3]</sup> Due to its major advantages, the use of herbal medicine has

increased significantly over the years. Herbal toothpaste such as miswak is popular when compared to conventional nonherbal kinds of toothpaste owing to their various characteristics, namely the presence of natural ingredients, alcohol-zero formulations, no artificial preservatives, and taste. They are proven to be efficient in decreasing plaque, gingival bleeding, and mouth odor.<sup>[4-6]</sup> Miswak is used for brushing in the form of a stick in most parts of the world and many studies have reported its bactericidal efficacy against anaerobic bacteria.<sup>[7,8]</sup>

*Eucalyptus* oil, procured from Australian *Eucalyptus* tree, produces an essential oil which is used to treat various diseases. Phytopharmacological process that includes

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drying, crushing, and distillation is used for extraction of essential components from *Eucalyptus* leaves.<sup>[9]</sup> Against *Haemophilus influenzae* and *Staphylococcus pyogenes*, *Eucalyptus* oil has high cytotoxic and antibacterial action.<sup>[10]</sup> Our study aims to investigate the efficacy of the selected herbal toothpastes regarding treatment of plaque and gingival bleeding.

## MATERIALS AND METHODS

The study was approved by the University ethical committee (D-H-S-2021-NOV-24-19). The research was conducted from September 1, 2021, to January 10, 2022. It is registered on clinicaltrials.gov (NCT05363956). The two herbal toothpastes which were used in this randomized crossover clinical study: miswak toothpaste (Dabur, India) contains primarily miswak, with traces of essential oils; *Eucalyptus* toothpaste (*Eucalyptus*-Bio [Argiletz, France]) contains green illite clay, essential oils, and primarily *Eucalyptus*. The study was done in accordance with the Helsinki Declaration and further revised in 2013.

### Patient selection

The sample size was determined using the PS program online version 3.16 (power and sample size calculations). A sample size of 30 was allotted for each group, putting the total number of participants at 60.<sup>[11]</sup> Participants medically fit, aged 20–60 years, with gingival inflammation (score of 1) were part of the inclusion criteria. Medically compromised patients taking medications for associated medical conditions, participants with periodontitis, participants who have received periodontal treatment in the past 6 months, and participants using herbal dentifrices were part of the exclusion criteria.

### Study design

This study was conducted over 3 weeks. The study was a crossover randomized single-blind design. The participants were briefed, and consent was taken. Randomization for the study was done by drawing lots. To achieve blinding, lots were given and a code was incorporated to assign participants to their respective groups. An oral examination was done on all participants at the beginning of the trial (baseline). The baseline score and the scores at different time points in the 20 days duration were recorded and follow-up was maintained.

A dentifrice labeled with a number was given to the participants. The modified bass technique was taught to the patients and they were instructed to brush for 2 min with a 1 cm streak of paste and asked to perform brushing twice daily. A video of the technique was given and the technique further demonstrated. At the first visit during morning hours, the Oral Hygiene Index was calculated using, Simplified Oral Hygiene Index,<sup>[12]</sup> and the gingival index of all teeth<sup>[11]</sup> was recorded. Those patients who demonstrated

bleeding scores of 2 and 3 in the initial examinations were excluded. All examinations were performed in the morning at all recall visits and done by the same examiner, as this helps in quantifying the results and reducing the risk of bias. The toothpaste was labeled as (1 Toothpaste) for miswak and (2 Toothpaste) for *Eucalyptus* oil.

Participants were instructed to use toothpaste one morning and night for 72 h. Three days later, evaluation was done for gingival bleeding and plaque. The 3 days study design was developed based on the 72 h plaque accumulation model by Marchetti *et al.*<sup>[13]</sup> Furthermore, to determine efficacy of the dentifrices, at the start of the study (baseline), oral prophylaxis was not performed and this was further validated by a landmark study by Page and Schroeder where gingivitis was observed on the 7<sup>th</sup> day.<sup>[14]</sup>

Following a 2-week washout period and to further prevent any bias in the outcome of our study, the participants were advised to use their routine toothpaste during the washout period and do not use any other herbal paste. To mitigate the possibility of bias, it was observed from previous studies that the interim (washout) period is at least five times more than the treatment's half-life.<sup>[15]</sup> At the baseline of toothpaste 2, the gingival and plaque scores of the participants were assessed.

Both herbal toothpastes (*Eucalyptus*-Bio, Argiletz, France) were given and instructed to be used for the next 3 days, twice a day. Plaque as well as gingival bleeding was evaluated 72 h after brushing in the morning [Figure 1].

## RESULTS

Analysis was done using SPSS software (version 28, Armonk, IBM Corp., New York, USA). Mann–Whitney *U*-test was used for intragroup comparison. Wilcoxon signed-rank test was performed for evaluation among the visit in each group to evaluate plaque and gingival index scores.  $P \leq 0.05$  was considered statistically significant.

Significant efficacy in plaque reduction was shown by both miswak and *Eucalyptus* paste [Tables 1 and 2], there was no statistical difference among the two. During the third visit [Table 2], participants were asked to use their routine toothpaste, scores of  $P = 0.083$  and  $P = 0.636$  were seen for miswak and *Eucalyptus* toothpaste, respectively.

When Plaque scores (PS) were compared between each visit, comparable difference was observed among both toothpaste,  $P < 0.05$ . Both groups exhibited significant changes in PS, comparing the second from the fourth visit. There was no statistically significant observation made in PS when seen overall between the pastes, as both exhibited equal efficacy [Tables 1 and 2].

**Table 1: Comparison of plaque index between the toothpastes at each time point**

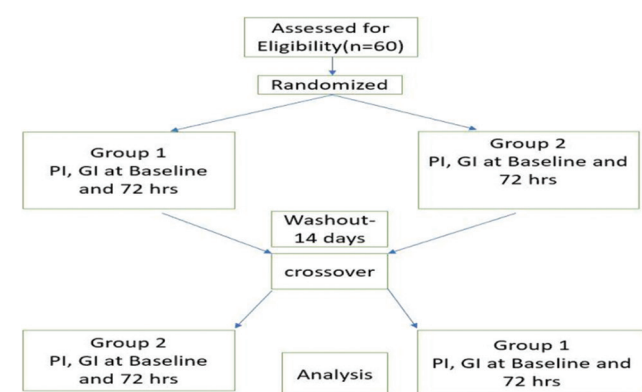
	Group 1		Group 2		P
	Median	IQR	Median	IOR	
Baseline	0.41	0.25–0.67	2	1.67–2.67	<0.001*
After miswak (72 h)	0.33	0.25–0.5	1.67	1.45–2	<0.001*
Oral hygiene (washout period-14 days)	0.42	0.25–0.42	1.67	1.5–1.83	<0.001*
After <i>Eucalyptus</i> oil (72 h)	0.31	0–0.5	1.3	1.2–1.67	<0.001*

\* $P < 0.05$  significance. IQR: Interquartile range

**Table 2: Comparison of plaque index at different time points in each group**

	Miswak	<i>Eucalyptus</i> oil
First-second	0.002*	<0.001*
Second-third	0.083	0.636
Third-fourth	<0.001*	<0.001*
Second-fourth	<0.001*	<0.001*

\* $P < 0.05$  significance

**Figure 1: Flowchart**

A significant finding was seen when evaluated among visits between the group along with observable change in gingival bleeding (GB) among the groups ( $P < 0.001$ ) [Table 3]. There was a further observable difference in gingival bleeding values among the groups when observed from baseline to the fourth visit. Comparing *Eucalyptus* (0.001) in reducing gingival bleeding, miswak was less (0.008) when evaluating the time points – second and fourth visit [Table 4].

## DISCUSSION

A study to evaluate miswak toothpaste when compared with another herbal paste (Paradontax) and a control routine chemical formulated paste (Colgate) was done.<sup>[16]</sup> There were no significant variations in approximal plaque index when compared to the Sulcus Bleeding Index (SBI) between any of the three groups. Compared to routine control, the herbal pastes reduced the SBI significantly. This was in agreement with the present study, where *Eucalyptus* oil-based toothpaste significantly reduced gingival bleeding when compared to miswak, but nevertheless did not show reduction in PS. In the current experimental study when

patients were placed in the washout period and instructed to use their routine toothpaste, no significant effect on plaque or gingival indices was observed.

The values obtained in our current study are consistent with an earlier study where utilizing miswak chewing gum along with scaling or without prophylaxis resulted in a significant gingival bleeding reduction.<sup>[17]</sup>

No oral health benefits were reported in another study which involved miswak toothpaste. A likely reason is miswak paste's active ingredients being lost during manufacturing.<sup>[18]</sup> A similar study using a randomized clinical crossover design to evaluate *Moringa oleifera* paste with miswak toothpaste, showed observable reduction in gingival bleeding and PS with relation to *Moringa* toothpaste, the values obtained in our study correlated to this, although the active ingredient was *Eucalyptus* oil-based paste.<sup>[6]</sup>

Retarding biofilm formation, bacterial adherence, and gingival inflammation were reported in studies related to *Eucalyptus camaldulensis* and *Mentha spicata* essential oils. This further strengthened the finding that essential oils can influence the development in biofilm and further help in the development of anticaries treatments.<sup>[19]</sup> In cancer patients with necrotic ulcers, when given *Eucalyptus* oil rinse and was instructed to rinse twice a day, it resulted in elimination of foul smell and complete reepithelialization where in some individuals the ulcers began to heal.<sup>[20,21]</sup> No evidence of extrinsic tooth stain with both herbal dentifrices was reported along with no adverse reactions seen throughout the duration of the study.

The duration of the study and the number of participants were some of the possible limitations in the current study. Maximal therapeutic benefit may not have achieved as the herbal dentifrices were given for 3 days only. Participants that were given miswak toothpaste reported a bland taste, whereas participants reported pleasant taste when given *Eucalyptus* toothpaste and they were willing to continue using it. Moreover, less significant gingival and PS shown by miswak when compared to *Eucalyptus* toothpaste could be due to the unpleasant taste of miswak, thereby possibly reducing the use of miswak paste by the participants. Furthermore, to understand the clinical performance of

**Table 3: Comparison of a gingival index among the toothpastes at each time points**

	Group 1		Group 2		P
	Median	IQR	Median	IQR	
Baseline	0	0–1	2.5	2–3	<0.001*
After miswak (72 h)	0	0–1	2	1–2	<0.001*
Oral hygiene (washout period-14 days)	0	0–1	1	1.75–2	<0.001*
After <i>Eucalyptus</i> oil (72 h)	0	0–1	1	1–2	<0.001*

\*P<0.05 significance. IQR: Interquartile range

**Table 4: Comparison of gingival index at different time points in each group**

	Miswak	<i>Eucalyptus</i>
First-second	0.025*	<0.001*
Second-third	0.564	0.157
Third-fourth	0.014*	<0.001*
Second-fourth	0.008*	<0.001*

\*P<0.05 significance

these herbal toothpastes, studies can be performed using larger sample size and longer time points.

## CONCLUSION

An active role was demonstrated by both herbal toothpaste in terms of gingival bleeding and plaque. In contrast to the high quantity of research done with relation to miswak, sparingly few have been published on the effects of *Eucalyptus* in the oral cavity. Further research on the efficacy of *Eucalyptus* oil is needed.

## Institutional ethical review

D-H-S-2021-NOV-24-19.

## Data availability

The current study is registered on clinicaltrials.gov (NCT05363956).

## Financial support and sponsorship

The study is self-funded.

## Conflicts of interest

There are no conflicts of interest.

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