Original Article

Comparative Evaluation on Clinical Efficacy of Active Oxygen Toothpaste with Herbal Toothpaste in Supragingival Plaque Reduction among Gingivitis Patients: A Randomized Controlled Trial

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Abstract

Context: Gingivitis is a soft-tissue inflammation of the gingiva. It is initiated in the oral cavity by the accumulation of plaque. Among the various plaque control methods, dentifrices play a major role to reduce the microbial load in gingivitis patients. Herbal dentifrice reduces plaque levels and gingival inflammation. In a revolutionary process on dentifrice, BlueM (BM) International has recently introduced the BM dentifrice. Its mechanism of action is to reduce inflammation by controlled delivery of reactive oxygen species to injury sites. **Aims:** The aim of this study was to compare the clinical efficacy of two commercially available toothpaste, BM, and Dabur Red (DR) in gingivitis patients. **Settings and Design:** To compare the anti-plaque and anti-gingivitis efficacy of two commercially available toothpaste by measuring gingival, plaque, and bleeding indices in gingivitis patients. **Subjects and Methods:** A total of 45 patients with chronic gingivitis were included in the study. After oral prophylaxis, they were divided into three groups: Group A, Group B, and Group C who received BM toothpaste, DR toothpaste, and placebo toothpaste, respectively. The clinical parameters were recorded at baseline, 1st, 2nd, and 3rd weeks. **Statistical Analysis Used:** Data on the gingival index (GI) and plaque index (PI) and bleeding index (BI) were statistically analyzed by the mean and standard deviation between the groups using analysis of variance with Statistical Package for the Social Sciences software (SPSS version 20.0) with a 95% confidence level ($P < 0.05$). **Results:** The three groups showed significant reduction ($P < 0.05$) in PI, GI, and BI from baseline. The BM has more significant mean PI and BI than DR. **Conclusions:** This study demonstrated that active oxygen toothpaste has comparable anti-plaque and anti-gingivitis efficacies with herbal toothpaste (DR).

Keywords: *BlueM, Dabur Red, gingivitis, reactive oxygen species*

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Clinical Relevance to Interdisciplinary Dentistry

Good toothpaste helps in plaque and caries free environment in the oral cavity. It helps in maintaining the healthy Endo-Perio and Perio-Prostho inter-relationship.

Introduction

Gingivitis is the most common type of soft-tissue inflammation in dental practice. Progression of untreated gingivitis will lead to periodontitis. The presence of plaque is the main etiology for both gingivitis and periodontitis. Worldwide various plaque control methods are used to reduce the microbial load

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of oral disease. Among them, dentifrices play a major role. Hence, various formulations have been tried in dentifrices to maintain better oral hygiene.[1] Due to natural resources, herbal dentifrices reduce plaque levels and gingival inflammation. Dabur Red® the herbal toothpaste mainly contains ingredients such as *Acacia* Arabia has an astringent effect, *Echinacea* has immune stimulatory properties, cinnamon has an antimicrobial effect, *Caryophyllus aromaticus* is a natural antiseptic, *Syzygium jambolanum* has an astringent and anti-inflammatory effect, peppermint oil has analgesic, antiseptic, and anti-inflammatory properties, and the pudina has better flavoring agents.[2]

In a revolutionary process on dentifrice, BlueM (BM) International (the Netherlands) has recently introduced the BlueM® dentifrice. The mechanism of BM toothpaste is to deliver active oxygen (H_2O_2) in a controlled manner directly to the treatment site. In contact with saliva sodium perborate in the toothpaste is converted into sodium borate and H_2O_2. In low concentrations of 0.003%–0.015%, hydrogen peroxide has a disinfectant action and occurs together with the antibacterial reactive oxygen species during the respiratory burst of neutrophils in normal wound fluid and for lipid peroxidation of bacterial cell walls and has a chemotactic effect on leukocytes. Through the glucose oxidase process, the honey in the toothpaste can gradually release oxygen when it comes into contact with the saliva in the mouth. Then, the oxygen molecules (O_2) can penetrate much deeper into the biofilm to kill the anaerobic bacteria. An oxygen molecule (O_2) can also penetrate much deeper into the perimucosal seal around the implant. Methyl salicylate has an antiseptic effect and there is some thought that methyl salicylate may have an anti-inflammatory effect as well. Lactoferrin potently stimulates the proliferation and differentiation of primary osteoblasts.[3]

There are limited studies are available regarding the efficacy of active oxygen-containing toothpaste over herbal toothpaste. Hence, the present study was to compare the clinical efficacy of active oxygen toothpaste and herbal toothpaste in supragingival plaque reduction among chronic gingivitis patients.

Subjects and Methods

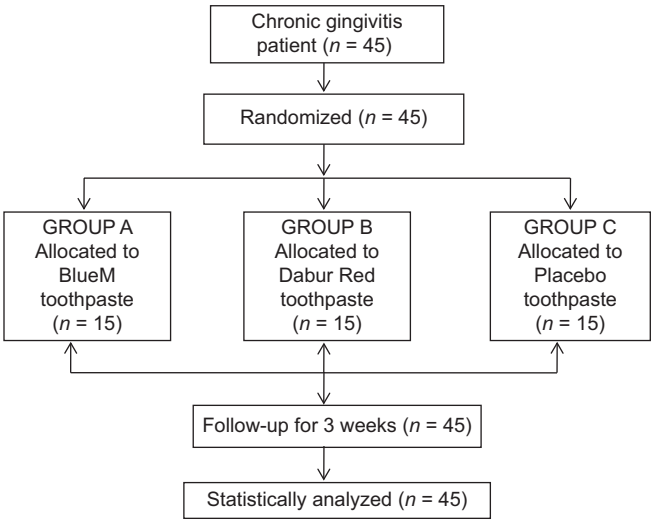
The study was designed as a single-blind, parallel, randomized controlled clinical trial where the participants could be blinded. It was calculated with 95% power and an alpha error of 0.05 with the required sample size was 11. Hence, 15 patients in each group were selected by a lottery method. In that way, 45 patients in the age group of 18–25 with chronic gingivitis and at least 28 natural teeth[4] with the absence of caries were selected from students of Vivekanandha Dental College for Women, Tiruchengode, Tamil Nadu.

The inclusion criteria were the gingival index (GI) ≥1 and plaque index (PI) ≥1 with no probing depth and no attachment loss. Willing participants with overall good health were included in the study. A written consent form was obtained from the participants. They were instructed to follow the protocols and they should not participate in other studies in the same duration.[5]

The exclusion criteria were the patients with periodontitis of probing depth >4 mm, participants with antibiotic therapy, any systemic conditions, smoking, presence of removable or fixed orthodontic appliances, and lack of compliance with the study were excluded from the study.[5]

A total of 45 patients were divided into three groups: Group A, Group B, and Group C containing 15 patients of each. After oral prophylaxis, Group A patients received 20 g of BM toothpaste, Group B patients received 20 g of Dabur Red (DR) herbal toothpaste, and Group C patients received 20 g of placebo toothpaste (PL) which contains 20 g of calcium carbonate and glycerol.

All the participants were instructed to brush their teeth for 3 min two times from day 1 to the completion of the study (3 weeks) with given toothpaste using the modified Bass method. The clinical parameter includes GI (Loe H and Silness P in 1963),[6] PI (Silness P and Loe H in 1971), and sulcus bleeding index (BI) (Muhlemann H R and Son S in 1971) were recorded on the baseline, 1st, 2nd, and 3rd week, respectively [Flow Chart 1].



Flow Chart 1: Methodology of the study

Statistical analysis

Data on GI and PI and BI were statistically analyzed by the mean and standard deviation between the groups using analysis of variance with the Statistical Package for the Social Sciences software (IBM® SPSS® statistics version 20.0) with a 95% confidence level ($P < 0.05$).

Results

All 45 study participants (45 females) completed the 3 weeks study period. At baseline, there were no significant differences among the groups in gingival, plaque, and bleeding indices. At baseline, the PI mean score for BM, DR, and PL were 2.74, 2.64, and 2.78, respectively [Table 1 and Graph 1]. The baseline GI mean score was 2.79, 2.81, and 2.83 [Table 2 and Graph 2]. The baseline BI mean score was 2.76, 2.78, and 2.8 for all the groups [Table 3 and Graph 3]. After the 21st day of results, the mean score for PI was 2, 2.14, and 2.59 for BM, DR, and PL, respectively [Table 1]. The mean GI was 2.06, 2.13, and 2.70 [Table 2]. The mean for BI was 1.93, 2.32, and 2.62 [Table 3]. Results reported for PI has been indicated the presence of significant differences between the baseline and 3rd week of results with a $P = 0.03$ ($P < 0.05$) for BM, $P = 0.04$ ($P < 0.05$) for DR, and a $P = 0.5$ ($P > 0.05$) for PL. For GI, the significant $P = 0.04$ ($P < 0.05$) for BM, $P = 0.05$ ($P \leq 0.05$) for DR, and a $P = 0.5$ ($P > 0.05$) for

Table 1: Comparison between groups according to the plaque index

Groups	PI (time period), mean±SD				*P*
	Baseline	At 1 week	At 2 weeks	At 3 weeks	
Group-A	2.74±0.15	2.56±0.20	2.31±0.18	2±0.20	0.03*
Group-B	2.74±0.15	2.56±0.22	2.40±0.27	2.14±0.22	0.04*
Group-C	2.78±0.16	2.7±0.14	2.64±0.17	2.59±0.21	0.51

*Statistically significant. SD=Standard deviation, PI=Plaque index

Table 2: Comparison between groups according to the gingival index

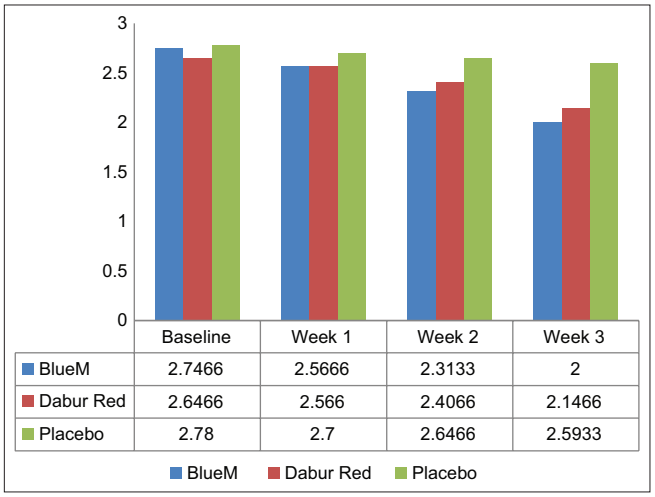
Groups	GI (time period), mean±SD				*P*
	Baseline	At 1 week	At 2 weeks	At 3 weeks	
Group-A	2.79±0.12	2.64±0.15	2.41±0.22	2.06±0.25	0.04*
Group-B	2.81±0.15	2.68±0.19	2.48±0.21	2.13±0.23	0.05*
Group-C	2.83±0.13	2.80±0.12	2.76±0.13	2.70±0.15	0.54

*Statistically significant. SD=Standard deviation, GI=Gingival index

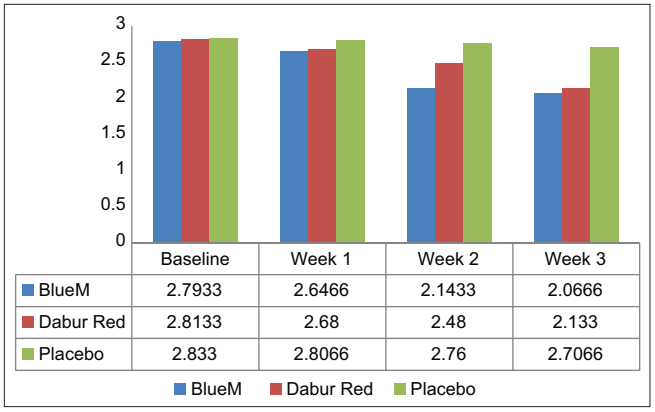
Table 3: Comparison between groups according to the bleeding index

Groups	BI (time period), mean±SD				*P*
	Baseline	At 1 week	At 2 weeks	At 3 weeks	
Group-A	2.76±0.22	2.6±0.26	2.38±0.27	1.93±0.13	0.002*
Group-B	2.78±0.21	2.56±0.22	2.50±0.23	2.32±0.3	0.03*
Group-C	2.8±0.19	2.7±0.14	2.70±0.16	2.62±0.15	0.52

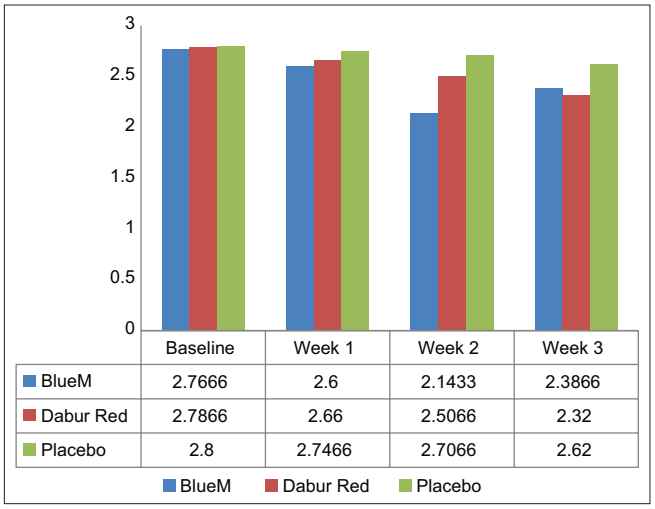
*Statistically significant. SD=Standard deviation, BI=Bleeding index



Graph 1: Graphical representation of the Plaque Index



Graph 2: Graphical representation of the Gingival Index



Graph 3: Graphical representation of the Bleeding Index

PL. For BI, the significant $P = 0.002$ ($P < 0.05$) for BM, $P = 0.03$ ($P < 0.05$) for DR, and $P = 0.5$ ($P > 0.05$) for PL. The intergroup comparison of Group A, Group B, and Group C at baselines were 0.154, 0.232, and 0.420 for GI, PI, and BI, respectively [Table 4]. The intergroup comparison of Group A, Group B, and Group C at 3rd week were 0.000, 0.001, and 0.002 for GI, PI, and BI, respectively [Table 5].

From the observed data, there were no significant differences among the groups at baseline and in 3rd week. There was a significant reduction of plaque, gingival, and bleeding indices in all three groups. In that, the clinical parameters show the most significant differences between BM toothpaste and DR toothpaste.

Discussion

Since dental plaque is the main factor for the development of gingivitis, untreated chronic gingivitis may lead to periodontal disease which ultimately destroys the supporting structures of the tooth.[1] Hence, the best plaque control measures help in the maintenance of proper oral hygiene. This can be effectively achieved by better mechanical plaque control methods such as toothbrush and medicated toothpaste.

Many studies have been done to prove the efficacy of nonherbal toothpaste with herbal toothpaste. Chemically, the nonherbal toothpaste mainly contains triclosan and chlorhexidine to prevent microbial load. However, some of these substances show side effects such as tooth staining and altered taste sensation. BM toothpaste has come under a revolutionary type of nonherbal toothpaste. This unique formula includes active oxygen from, i.e., honey, with xylitol and lactoferrin as supplemental active ingredients. Meanwhile, the following reports of Ozaki *et al*. and Sushma *et al*. showed (19.9% and 18.3% plaque reduction) and (60.36% and 59.89% gingivitis reduction), respectively, for herbal toothpaste over nonherbal toothpaste.[7,8]

Table 4: Intergroup comparison of parameters at baseline

Parameters	df	*F*	*P*
GI	2	1.318	0.154
PI	2	1.345	0.232
BI	2	0.814	0.420

GI=Gingival index, PI=Plaque index, BI=Bleeding index

Table 5: Intergroup comparison of parameters in 3rd week

Parameters	df	*F*	*P*
GI	2	2.385	0.000*
PI	2	8.030	0.001*
Probing depth	2	2.462	0.002*

*Statistically significant. GI=Gingival index, PI=Plaque index

The main purpose of the present study was to evaluate and compare the efficacy of active oxygen-containing toothpaste and herbal toothpaste with PL in the reduction of plaque and gingivitis. In this study, all 45 participants (45 females) completed the 3-week study duration. To decrease the periodontal variability, participants were selected from college students.

The study demonstrated that at baseline, there was no significant difference among the groups. In 3rd week, there was a significant amount of plaque reduction (2 ± 0.20, 2.14 ± 0.2, and 2.59 ± 0.21 for Groups A, B, and C, respectively) and gingivitis reduction (2.06 ± 0.25, 2.13 ± 0.23, and 2.70 ± 0.15) among the groups. Moreover, the results demonstrated that both toothpastes in this study showed an effective reduction of plaque and gingival inflammation. Several studies have proven the anti-plaque and anti-gingival effects of herbal toothpaste when compared to those of conventional toothpaste.[7-9] However, BM may be considered more effective than DR. Because BM toothpaste contains lactoferrin, which is a protein that possesses iron binding/transferring, antibacterial, antifungal, antiviral, anti-inflammatory, and anticarcinogenic properties.[10] A recent randomized clinical trial has demonstrated that a toothpaste containing enzymes and proteins was effective at preventing gingivitis compared to tooth brushing with a commercially available fluoride toothpaste.[11] Therefore, the selection of toothpaste with superior plaque removal properties may be fundamental for the maintenance of patient's oral health. Other studies have reported that the regrowth of dental plaque can be arrested by proper oral hygiene techniques.[12,13]

Limitations of this study include the short period of study duration with a small study population. Hawthorne effect may get noticed. Further studies have been required for the large population of long duration.

Within the limitations, the present study demonstrated the effect of oxygen-containing toothpaste and herbal toothpaste in the oral hygiene maintenance of gingivitis patients. It also showed that oxygen-containing toothpaste is more potent than herbal toothpaste.

Conclusions

Oral hygiene maintenance is as much as essential in our day-to-day life process. Many toothpastes are commercially available in the market to attract patient interaction. Hence, the prescription of the correct toothpaste is the dentist's responsibility. In that way, active oxygen toothpaste has comparable plaque

reduction and gingival inflammation reduction in gingivitis patients over herbal toothpaste.

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Conflicts of interest

There are no conflicts of interest.

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