

## Comparative effect of Herbal and Carbopol formulated dentifrices on established gingivitis

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### Abstract

**Introduction:** Bacteria in dental plaque are one of the main etiological factors causing periodontal disease. Gingivitis is common and non-specific inflammatory reaction to a complex indigenous micro-biota. Supra-gingival plaque control is an effective method of controlling gingivitis and the most widely practiced form of oral hygiene is tooth brushing with a dentifrice. Carbopol dentifrice has added properties like mucoadhesion and polymeric mineral surface active agents like carbomers making it superior to other dentifrices for controlling gingivitis.

**Purpose:** To evaluate and compare the effectiveness of Herbal dentifrice and Carbopol formulated dentifrice in subjects with established gingivitis.

**Materials and Method:** 30 subjects with chronic marginal gingivitis were selected and randomly divided into 2 groups. Group 1 received Carbopol formulated dentifrice. Group 2 received Herbal dentifrice. Subjects were asked to use the allocated dentifrice, two times a day, for 42 days. Values of Simplified oral hygiene index, Plaque index, Gingival index, and Sulcular bleeding index were assessed at baseline, after 21 and at 42 days. Data was analyzed by Student's t-test ( $\alpha = 0.05$ ).

**Results:** Oral hygiene (tooth brushing with dentifrices for 42 days) led to a significant decrease in plaque accumulation by 13% in group 1 and 8% in group 2. Simplified oral hygiene index showed improvement by 23% in group 1 and 10% in groups 2, Gingival sulcus bleeding showed reduction by 62% in group 1 and 24% in group 2 and gingival inflammation decreased by 14% in group 1 and 9% in group 2. Outcome of various indices in Carbopol formulated group (Gp1) showed a significant improvement in all the parameters ( $P < 0.05$ ), except sulcular bleeding index from baseline to 42 days as compared to the Herbal test group (Gp2).

**Conclusion:** Continuous use of Carbopol formulated dentifrice provided significant improvement of oral hygiene level in patients with established gingivitis.

**Keywords:** Dental plaque, Gingivitis, Herbal, Carbopol formulated, Dentifrice

### Introduction

Dental plaque is a microbial biofilm which is invariably present on the hard and soft tissues of the oral cavity and it contains a complex blend of various microorganisms. Plaque is considered as the precursor of dental caries, gingivitis and periodontitis. The prevention and control of dental caries and periodontal disease is dependent on optimal plaque control.<sup>(1)</sup> Self-performed mechanical plaque removal is an unquestioned method of controlling plaque and gingivitis.<sup>(2)</sup> The considerable prevalence of gingival inflammation within the general population suggests that most patients practice inadequate oral hygiene, particularly within certain regions of their mouths and in certain areas of their teeth.<sup>(3)</sup> The need for additional help in controlling bacterial plaque provides the rationale for patients to use antimicrobial dentifrices in addition to their mechanical oral hygiene regimens.<sup>(4)</sup>

A number of controlled clinical trials have demonstrated that tooth brushing with herbal dentifrices reduces supra-gingival plaque and gingivitis.<sup>(5)</sup> Interest in natural-based toothpastes has increased recently. Of the various herbal dental products considered, Hiora-K (Himalaya herbal healthcare) has received great

attention. It is composed of certain herbal extracts like Palakya (spinacia oleracea), Triphala, Trikatu. Palakya (spinacia oleracea) that contain natural oxalate compounds, which help in forming phytocomplexes on the teeth that occludes dentinal tubules and blocks the pain transmission. It also contains certain herbal powders like Suryakshara and Yashodabhasma that have immune stimulatory properties and are natural antiseptic. Naturally derived Suryakshara (potassium nitrate) inhibits pain in hypersensitive teeth through its desensitizing effect on dentinal nerves. Oils like Twak (cinnamomum zeylanicum) that act as natural anti-inflammatory agent and Lavanga (syzygium aromaticum) are also present. Lavanga (clove) contains an anesthetic chemical compound called eugenol and oil of clove that acts as an antiseptic. Sukumaran<sup>(6)</sup> conducted a study to evaluate the efficacy and safety of Hiora-K toothpaste on sensitive tooth and the efficacy parameters showed good results with an overall improvement and no adverse effects.

Good plaque control preserves oral health for a lifetime. Many clinical studies clearly indicate that the major deposits of plaque form in stagnation areas, such as the proximal areas, gingival margins, and defects in the teeth.<sup>(7)</sup> These areas are protected from the natural

cleansing mechanisms of oral tissues. Thus, emphasis must be placed on the effectiveness and efficacy of plaque-removing devices used to facilitate oral hygiene in these elusive areas.<sup>(2)</sup> As tooth brushing is the most common oral hygiene method, dentifrices are the most ideal vehicle for the daily delivery of antibacterial agents. These chemotherapeutic agents should provide a preventive effect against caries and gingivitis.<sup>(8)</sup>

The other toothpaste used in this study is the Carbopol formulated dentifrice. In the recent decades, there has been considerable interest in using Carbopol as an excipient in a diverse range of pharmaceutical applications. Carbopol polymers or carbomers are polymers of acrylic acid cross-linked with poly-alkenyl ethers or di-vinyl glycol. They are produced from primary polymer particles of about 0.2 to 6.0 micron average diameter. Each particle can be viewed as a network structure of polymer chains inter-connected via cross-linking.<sup>(9)</sup> Carbomers were first prepared and patented in 1957.<sup>(10)</sup> Sensodyne repair & protect is a recent advancement that has Carbopol as its active constituent. Apart from being efficient thickeners and binders, they deliver the added benefit of mucoadhesion i.e. it retains on the mucosal surfaces. The polymeric mineral surface active agent protects enamel surface from demineralization, prevents biofilm attachment to enamel thus reducing gingivitis, delays plaque mineralization and enhances deposition of active compounds to enamel surfaces. The microgel structure of Carbopol polymers also imparts a shear-thinning property to the system. To the best of our knowledge, this is the first study done to evaluate the effectiveness of Carbopol on established gingivitis.

The main aim of this study was to evaluate the efficacy of Carbopol formulated dentifrice for the improvement of oral hygiene and the reduction of gingival inflammation in patients with established gingivitis as a whole, in comparison to Herbal dentifrice.

## Materials and Method

30 subjects diagnosed with chronic marginal gingivitis with generalized probing depth of 2-3mm having no radiographical signs of bone loss were selected from the out-patient department of Periodontology, Subharti Dental College & Hospital, Meerut. The subjects were randomly allocated to one of the two groups. Group 1 (n=15) - Brushed twice daily with Carbopol formulated dentifrice (Sensodyne repair & protect). Group 2 (n=15) - Brushed twice daily with Herbal dentifrice (Hiora-K, Himalaya herbal healthcare). Technique of brushing in both the groups was modified bass technique. The subjects were informed about the study, and their consent was obtained in a prescribed form. The study was carried out after approval by the ethical committee of Swami Vivekananda Subharti University.

## Inclusion criteria

- 20-40 yrs of age
- Poor oral hygiene status
- Signs of gingival inflammation corresponding with chronic marginal gingivitis
- Systemically healthy

## Exclusion criteria

- Advanced periodontal inflammation
- Fixed orthodontic appliances
- Patients on antibiotics or anti-inflammatory medicines
- Pregnant females and nursing mothers
- Patient on anti-inflammatory or antibiotic medication during the study
- Large carious lesions
- Non-compliant subjects

Oral examination was performed at the beginning of the study (baseline), after 21 days (3 weeks) and at 42 days (6 weeks).

## The following parameters were assessed:

- Simplified oral hygiene index (OHI-S)<sup>(11)</sup>
- Sulcular bleeding index (SBI)<sup>(12)</sup>
- Gingival index (GI)<sup>(13)</sup>
- Plaque index (PI)<sup>(14)</sup>

Study data obtained were entered into statistical software (Microsoft excel for Windows 7; Statsoft Inc., Tulsa, OK) and Student's t-test was used to compare the difference between groups. Results were tested for significance at the  $P < 0.05$  level.

## Results

**Evaluation of oral hygiene status:** The baseline examination showed that the oral hygiene status of all subjects was unsatisfactory according to Simplified oral hygiene index (OHI-S) and Plaque index (PI).

**Evaluation of Simplified oral hygiene index (OHI-S):** Table 1 and Fig. 1 shows differences in OHI-S values from baseline to 42 days in Carbopol formulated group. Table 2 and Fig. 2 shows difference in OHI-S values from baseline to 42 days in Herbal group. Both were not significant ( $P > 0.05$ ). The percentage difference in Carbopol formulated group and Herbal group between baseline and 42 days was 23% and 10% respectively. Table 3 shows difference in P value between baseline and 42 days in carbopol formulated and herbal group was statistically significant 0.018 ( $P < 0.05$ ).

**Evaluation of Plaque index (PI):** Table 1 and Fig. 1 shows differences in plaque index values from baseline to 42 days in Carbopol formulated group. Table 2 and Fig. 2 shows difference in plaque index values from baseline to 42 days in Herbal group. Both were not significant ( $P > 0.05$ ). The percentage difference in Carbopol formulated group and Herbal group between baseline and 42 days was 13% and 8% respectively.

Table 3 shows difference in P value between baseline and 42 days in Carbopol formulated group and Herbal group was statistically significant 0.003 (P < 0.05).

**Evaluation of periodontal status:** Baseline data revealed that all participants had signs of gingival inflammation (GI): bleeding on probing, hyperemia, and edema of the gingival margin.

**Evaluation of Gingival index (GI):** Table 1 and Fig. 1 shows differences in gingival index values from baseline to 42 days in Carbopol formulated group. Table 2 and Fig. 2 shows differences in gingival index values in Herbal group from baseline to 42 days. Both were not significant (P > 0.05). The percentage difference in Carbopol formulated group and Herbal group between baseline and 42 days was 14% and 9% respectively. Table 3 shows difference in P value

between baseline and 42 days in Carbopol formulated group and Herbal group was statistically significant 0.004 (P < 0.05).

**Evaluation of Sulcular bleeding index:** Table 1 and Fig. 1 shows differences in sulcular bleeding indices values from baseline to 42 days in Carbopol formulated group. Table 2 and Fig. 2 shows differences in sulcular bleeding index values from baseline to 42 days in Herbal group. Both were not significant (P > 0.05). The percentage difference in carbopol formulated group and herbal group between baseline and 42 days was 13% and 6% respectively. Table 3 shows difference in P value between baseline and 42 days in carbopol formulated and herbal group was statistically insignificant 0.167 (P > 0.05).

**Table 1: Intra-group comparison of all parameters in Group 1 over 42 days using student's t-test**

Clinical Parameter	Carbopol formulated (Gp1) [n=15]			
	Baseline	21 days	42 days	% difference between baseline and 42 days
Oral hygiene index (OHI-S)	4.32	3.71	3.34	23%
Plaque index (PI)	2.01	1.87	1.76	13%
Gingival index (GI)	2.13	1.93	1.83	14%
Sulcular bleeding index (SBI)	83.08	75.52	72.63	13%

**Table 2: Intra-group comparison of all parameters in Group 2 over 42 days using student's t-test**

Clinical Parameter	Herbal (Gp2) [n=15]			
	Baseline	21 days	42 days	% difference between baseline and 42 days
Oral hygiene index (OHI-S)	4.28	4.04	3.84	10%
Plaque index (PI)	2.04	1.97	1.88	8%
Gingival index (GI)	2.17	2.09	2.0	9%
Sulcular bleeding index (SBI)	80.6	77.54	75.88	6%

**Table 3: Inter-group P value difference between baseline and 42 days; \* Statistically significant at P < 0.05**

Clinical Parameter	Carbopol formulated (T1) [n=15]		Herbal (T2) [n=15]		P value difference between baseline and 42 days
	Baseline	42 days	Baseline	42 days	
Oral hygiene index (OHI-S)	4.32	3.34	4.28	3.84	0.018*
Plaque index (PI)	2.01	1.76	2.04	1.88	0.003*
Gingival index (GI)	2.13	1.83	2.17	2.0	0.004*
Sulcular bleeding index (SBI)	83.08	72.63	80.6	75.88	0.167

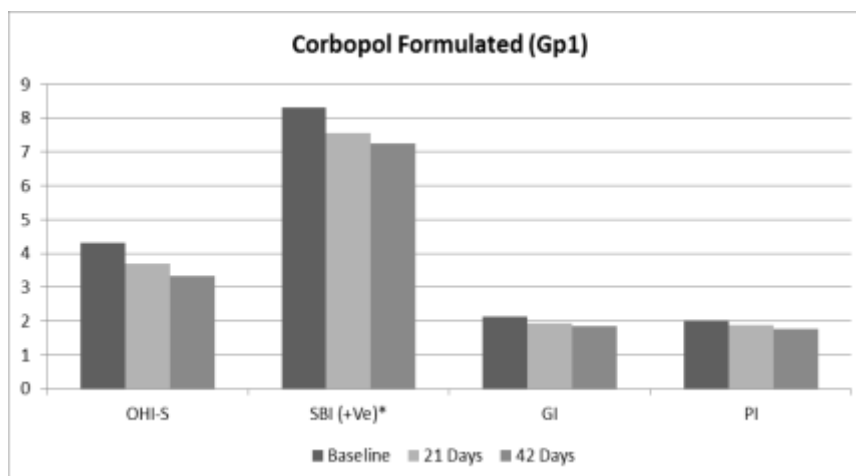


Fig. 1: Comparison of all parameters in Carbopol formulated (Gp1) over 42 days

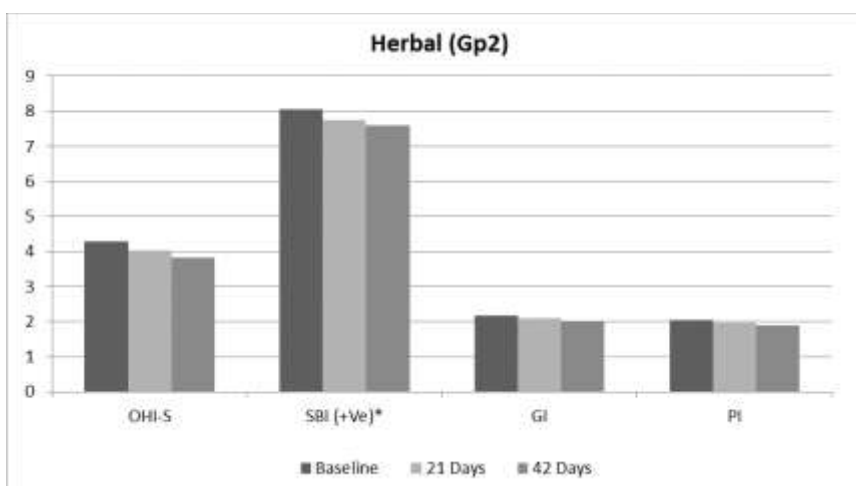


Fig. 2: Comparison of all parameters in Herbal (Gp2) over 42 days

### Discussion

To the best of author's knowledge this was the first study to compare the effectiveness of Carbopol formulated dentifrice in established gingivitis subjects. The results of the clinical study demonstrated that both of the carbopol formulated dentifrice and herbal dentifrice were effective and led to an improvement in oral hygiene and in the periodontal status in patients with established gingivitis. After 21 days, considerable improvement of periodontal condition was observed in both groups; this reduction may be partially due to the mechanical brushing which to some extent eliminates and controls the microbial plaque.

The use of Carbopol formulated dentifrices led to a considerable reduction in dental plaque accumulation both on smooth and approximal tooth surfaces. After 42 days, final values of all indices except for sulcular bleeding in Carbopol formulated groups were significantly lower compared to baseline data and to corresponding values in the herbal group. Carbopol formulated dentifrices use increased the effectiveness of plaque control. Probably, active ingredients of the

Carbopol formulated dentifrices penetrate the biofilm and prevent plaque accumulation.

A double-blinded controlled clinical study with parallel groups was done to investigate the effectiveness of a herbal-based toothpaste in cases of gingivitis and concluded that the herbal-based toothpaste was as effective as the conventional dentifrice.<sup>(15)</sup> Ibrahim K et al<sup>(16)</sup> conducted a study to assess the microbial quality and the effectiveness of seven brands of toothpaste. They found that 71% of the toothpaste brands were found to significantly (p=0.068) increase saliva bacteria. The two triclosan-containing toothpastes exerted a greater reduction in mouth bacteria which was followed by the herbal toothpaste and fluoride showed the least.

In the present study, Carbopol formulated tooth paste was more effective for the reduction of dental plaque than Herbal tooth paste with significant differences. This may be due to the three pillars of Carbopol polymers which include their ability of controlled release,<sup>(17)</sup> bioadhesion<sup>(18)</sup> and long term stability in oral suspensions.<sup>(19)</sup> However, there was no significant differences of sulcular bleeding index values

between both the groups after 42 days, indicating equivalence of Carbopol formulated and Herbal dentifrices in improving bleeding score.

### **Conclusion**

Regular application of Carbopol formulated dentifrice during 42 days provided significant reduction of dental plaque accumulation and some signs of gingival inflammation. These agents possess bactericidal activity against most of the periodontal pathogens without a negative influence on the normal micro-flora. Further long term studies are required to see the effect of these dentifrices on gingival and periodontal inflammation.

### **References**

1. Axelsson P, Lindhe J, Nystrom B. On the prevention of caries and periodontal disease. Results of a 15- year longitudinal study in adult. *J Clin Periodontol* 1991;18:182-9.
2. Caton JG, Blieden TM, Lowenguth R, Frantz BJ, Wagener CJ, Doblin JM et al. Comparison between mechanical cleansing and an antimicrobial rinse for the treatment and prevention of interdental gingivitis. *J Clin Periodontol* 1993;20:172-8.
3. Abdulwahab I, Al-Kholani. Comparison between the efficacy of herbal and conventional dentifrices on established gingivitis. *Dent Res J* 2011;8(2):57-63.
4. Barnett ML. The role of therapeutic antimicrobial mouthrinses in clinical practice: control of supragingival plaque and gingivitis. *J Am Dent Assoc* 2003;134(6): 699-704.
5. Pannuti CM, Mattos JP, Ranoya PN, Jesus AM, Lotufo RF, Romito GA. Clinical effect of a herbal dentifrice on the control of plaque and gingivitis: A double-blind study. *Pesqui Odontol Bras* 2003;17(4):314-8.
6. Sukumaran VG, Vivekanandan T, Amutha D. An open clinical study to evaluate the efficacy and safety of Hiora-K toothpaste in the management of sensitive tooth. *The Antiseptic* 2010;107(8):379-82.
7. Perry DA, Schmid MO. Plaque control. In: Carranza FA, Newman MG, editors. *Clinical Periodontology*, 8th ed. WB Saunders Co 1995:493–508.
8. Frandsen A. Changing patterns of attitudes and oral health behavior. *Int Dent J* 1985;35:284-90.
9. Florence AT, Jani PU. Novel oral-drug formulations-their potential in modulating adverse effects. *Drug Saf* 1994;410(3):233-66.
10. Brown HP. US Patent 1957;2798053.
11. Greene JC, Vermillion JR. The simplified oral hygiene index. *J Am Dent Assoc* 1964;68:7-13.
12. Muhleman HR. Gingivitis in Zurich school children. *Helvetica Odontologica Acta* 1958;2:3-7.
13. Loe H, Silness J. Periodontal disease in pregnancy. I. prevalence and severity. *Acta Odontol Scand* 1963;21:533-51.
14. Lange DE, Plagmann HC, Eenboom A, Promesberger A. Clinical methods for the objective evaluation of oral hygiene. *Dtsch Zahnarzt Z* 1977;32(1):44-7.
15. Jacob G, Hegde S, Rajesh KS, Kumar A. The efficacy of a herbal-based toothpaste in the control of plaque and gingivitis: A clinico-biochemical study. *Indian J Dent Res* 2009;20(4):480-2.
16. Okpalugo J, Ibrahim K, Inyang US. Toothpaste formulation efficacy in reducing oral flora. *Trop J Pharm Res* 2009;8(1):71-7.
17. Ishikawa S. Evaluation of the rheological properties of various kinds of carboxyvinyl polymer gels. *Chem Pharm Bull* 1988;36(6):2118-27.
18. Briede RH. Application of carbomer water gel 1%. *Pharm Week* 1983;118(9):170-4.
19. Anlar S, Capan Y, Hincal AA. Physico-chemical and bioadhesive properties of polyacrylic acid polymers. *Pharmazie* 1993;48(4): 285-7.