

The efficacy of an herbal-based toothpaste on the control of plaque and gingivitis

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Abstract

The efficacy of an herbal-based toothpaste on the control of plaque and gingivitis was investigated in a double-blind study on 40 subjects aged 22-54 years. Over a period of 8 weeks, 20 subjects used either control or preparations containing herbal ingredients. Parameters measured were the plaque, gingival and bleeding indices. These examinations were determined at baseline, 2, 4, 6 and 8 weeks. The test and control toothpastes significantly reduced all parameters measured in comparison to the baseline values ($p < 0.0001$) at all trial periods. In the present study, the herbal toothpaste was no more effective than the control toothpaste in reducing plaque and gingival inflammation. The test toothpaste exhibited slightly lower number of plaque, gingival and bleeding indices than the control toothpaste at all trial periods, but the differences were not statistically significant. Thus, the present results did not demonstrate a significant clinical advantage of the herbal-based toothpaste over the control toothpaste.

Key words: gingival indices, herbal-based toothpaste

Introduction

Retention of bacterial plaque along the gingival margin is detrimental to gingival and periodontal health^{1,2}. Tooth brushing is a common method of tooth cleaning and is an effective technique for plaque control. However, only mechanical tooth

brushing may not guarantee successful plaque prevention. Herbal ingredients and sodium salts have been incorporated into oral hygiene products to enhance the efficacy of brushing and to provide anti-plaque benefit and antimicrobial effect against oral microbial flora. Mixtures of chamomile, echinacea, myrrh, rhatany and several essential oils have been added in

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toothpaste and mouthwash products. Chamomile has anti-inflammatory properties while echinacea has an activating effect on leukocytes³, thus increases the oral resistance to infections. Sage has a reputation of antiseptic whereas myrrh has both antiseptic and astringent properties³. Rhatany contains tannins and is claimed to have hemostatic effect, and it was widely used as an astringent³. The antibacterial effect of essential oils and essential oil components towards oral bacteria has been reported. Shapiro et al⁴ reported that peppermint and sage oils are the most potent essential oils for antimicrobial properties. In addition, essential oils also provide refreshing and deodorizing properties. Parsley-seed oil has been used as a breath sweetener³. Sodium bicarbonate has been incorporated into various toothpastes because of its effect on plaque inhibition and buffering capacity⁵⁻⁷. Sodium bicarbonate salts increase the oral pH and potentially neutralize harmful effects of bacterial metabolic acids^{8,9}. The antibacterial action of salts such as sodium bicarbonate, sodium chloride, and magnesium sulfate is generally attributed to the osmotic pressure changes caused by hypertonic solutions of these agents^{10,11}. Several herbal-based toothpastes and mouthwashes with different medicinal herbs have been reported to be effective in the control of plaque and gingival disease^{5,6,12-17}.

The aim of this study was to investigate the efficacy of an herbal-based toothpaste on the control of plaque and gingivitis. This test toothpaste was composed of sodium chloride, sodium bicarbonate, and herbal extracts including chamomile, echinacea, myrrh, sage and parsley seed oil. It had an alkaline pH of 9.

Subjects and Methods

Subjects

Employees of the Chulalongkorn University Dental School were invited to participate in the study. Selection criteria were adopted from Mullally et al¹⁸. The subjects should have at least 20 natural teeth with no periodontal pockets greater than 3 mm. Each subject had gingivitis as defined by bleeding on gentle probing at more than 30% and a gingival index of 1 at more than 60% of the sites examined. At baseline, each subject also had a plaque index of greater than 2. Subjects with removable prostheses or appliances, advanced bridgework or multiple full coverage restorations were excluded. All subjects were medically healthy and none

were undergoing antibiotic or anti-inflammatory therapy or had undergone such therapy in the previous one month. Female subjects were not pregnant. No subjects had a history of known sensitivity or oral mucosal tissue reaction to toothpaste. No subjects had periodontal treatment in the 4-week period prior to the baseline examination as well as during the experimental period. Informed written consents to participate in the study were obtained from all participants.

Methods

The subjects were divided into two groups with equal number. The test and control groups were not significantly different in their demographics, baseline plaque, and gingival and bleeding indices. Subjects in the test group were given the herbal toothpaste whereas subjects in the control group were given the control toothpaste (a formulation minus herbal ingredients). The study was conducted in a double blind manner in that the examiner (TP) did not know which product the subjects were using. The tubes of toothpaste were delivered to the subjects in plain white tubes with number codes. The subjects were not told what product they were using. Each subject was supplied with one new toothbrush at baseline and another one at 4 weeks of the study. The subjects were asked to brush their teeth twice daily, using only the toothpastes and toothbrushes provided by the investigator during the 8-week period. No instructions were given concerning the use of the products or brushing techniques. Participants were asked to refrain from the use of accessory methods of tooth cleaning and oral rinses for the duration of the study. Subjects returned all toothpaste tubes and toothbrushes at the end of the study so that their compliance could be evaluated.

Clinical data collection

The examination was conducted in the morning between 9.00-12.00 at baseline, 2, 4, 6 and 8 weeks. One examiner (TP) performed all the clinical measurements. The index teeth were #17, 15, 13, 11, 22, 24, 26, 37, 35, 33, 31, 42, 44, and 46 (FDI tooth numbering system). Gingival and plaque status were measured using three indices, beginning with gingival index (GI), followed by bleeding index (BI) and plaque index (PI). GI was assessed at the midbuccal, mesiobuccal, midlingual/palatal and distolingual/palatal of each index tooth, and score ranged 0-3 according to Löe and Silness¹⁹. Mean GI for each subject was calculated from the combined scores of all sites divided by the number of sites

examined. BI was assessed at the buccal and lingual gingival crevices of index teeth by using a blunt pocket probe for gentle probing. If bleeding occurred within about 10 seconds after testing, a positive finding was recorded as described by Ainamo and Bay²⁰. BI was calculated from the number of bleeding sites divided by the number of gingival margins examined. Percentage of bleeding sites was also calculated. PI was assessed at the buccal and lingual nonrestored surfaces of each index tooth after application of disclosing solution (erythrosine), and score ranged 0-5 as described by Quigley and Hein²¹. Mean PI for each subject was calculated from the combined scores of all surfaces divided by the number of surfaces examined.

Statistical analyses

Statistical analyses were conducted by using SPSS 9.0 for Windows. Descriptive statistics for variables were analyzed by the chi-square and t-tests. Comparison of the indices within the test and control groups at baseline and at all trials were analyzed by means of paired t-test, with the level of significance taken at $p < 0.05$.

Results

Forty-four subjects entered the study, with equal number in the test and control groups. No statistically significant

differences were observed between the test and control groups for any of the inclusion parameters assessed. Forty subjects completed the study, with 20 in the test group and 20 in the control group. There were 12 women, 8 men in the test group and 13 women, 7 men in the control group. Mean age for the test and control groups were 32.5 ± 7.9 years and 34.9 ± 7.8 years, respectively. The reasons for exclusion of the four subjects were that one subject was hypersensitive to the test toothpaste, one subject took antibiotic for respiratory tract infection, and two subjects used other toothpastes during the study.

Plaque level

Figure 1 shows the mean PI at all trial periods. The mean PI for the test and control groups at 2-, 4-, 6- and 8-week examinations were not significantly different. However, at 2, 4, 6, and 8 weeks, subjects in the test and control groups had statistically significant lower PI scores than did at the baseline ($p < 0.0001$).

Figure 2 shows the percentage reduction in plaque levels from baseline of the test and control groups at 4 trial periods. Although the test group showed greater reduction in PI scores than the control group in each trial period, these differences did not reach statistically significant.

At 8 weeks, subjects in the test group showed slightly lower PI than subjects in the control group (1.81 ± 0.43 vs.

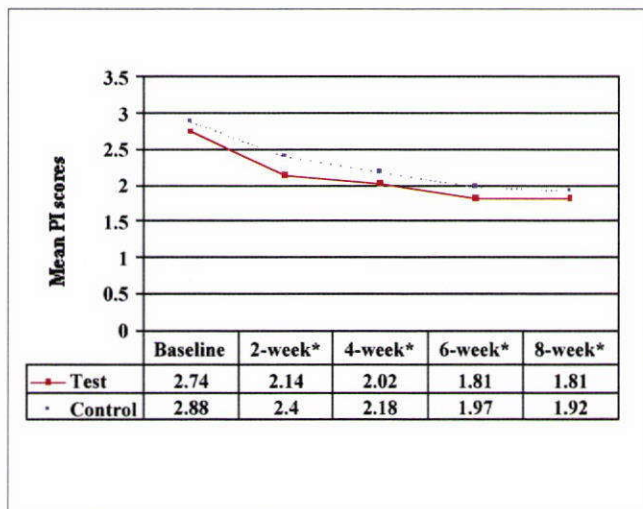


Fig. 1 The mean plaque indices at baseline, 2, 4, 6, and 8-week examinations of the test and control groups; *significant decrease from baseline ($p < 0.0001$).

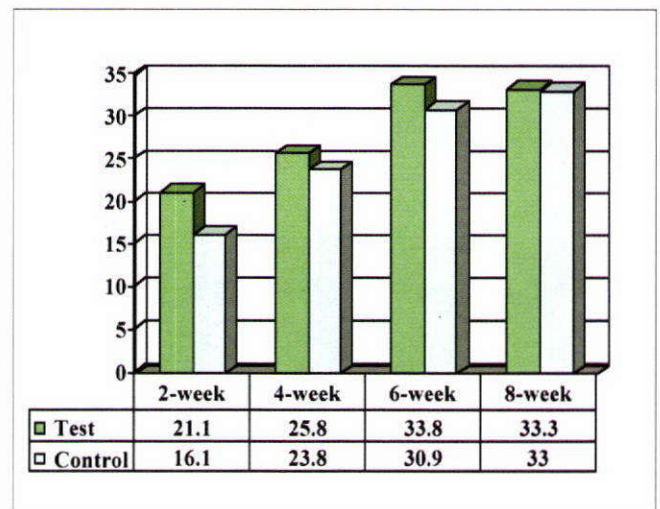


Fig. 2 Percentage reduction in plaque levels from baseline at 2, 4, 6, and 8-week examinations in the test and control groups (no significant differences between the test and control groups).

1.92 ± 0.47). Percentage of plaque reduction at final was not different between the test and control toothpastes (33.3% vs. 33%).

Gingival inflammation

Figure 3 shows the mean GI at all trial periods. The mean GI for the test and control groups at 2-, 4-, 6- and 8-week examinations were not significantly different. At 2, 4, 6 and 8 weeks, subjects in the test and control groups had statistically significant lower GI scores than did at the baseline ($p < 0.0001$).

Figure 4 shows the percentage reduction in gingival inflammation from baseline of the test and control groups at 4 trial periods. The inflammatory reduction percentages of both

groups in each trial period were quite similar.

At 8 weeks, the GI scores for the test and control groups were not different (0.51 ± 0.17 vs. 0.51 ± 0.18). The test and control groups also showed similar reduction in GI scores from the baseline values (63.8% vs. 64.4%).

Gingival bleeding

Figure 5 shows the mean BI at all trial periods. There were no significant differences in the mean BI for the test and control groups at 2-, 4-, 6- and 8-week examinations. At 2, 4, 6, 8 weeks, subjects in both groups showed statistically significant lower BI scores than did at the baseline ($p < 0.0001$).

Figure 6 shows the percentage reduction in gingival bleeding of the test and control groups in compare to the

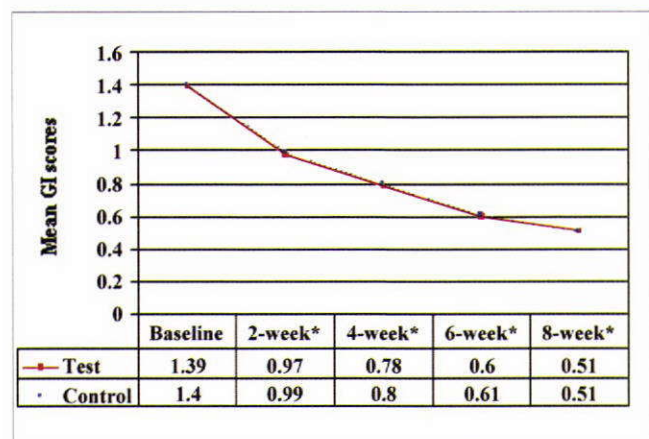


Fig. 3 The mean gingival indices at baseline, 2, 4, 6, and 8-week examinations of the test and control groups; *significant decrease from baseline ($p < 0.0001$).

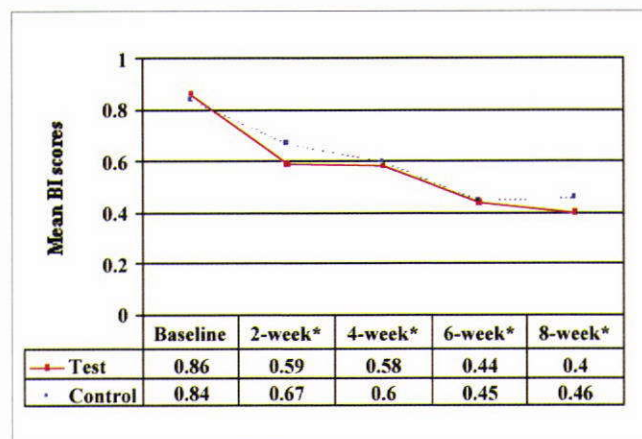


Fig. 5 The mean bleeding indices at baseline, 2, 4, 6, and 8-week examinations of the test and control groups; *significant decrease from baseline ($p < 0.0001$).

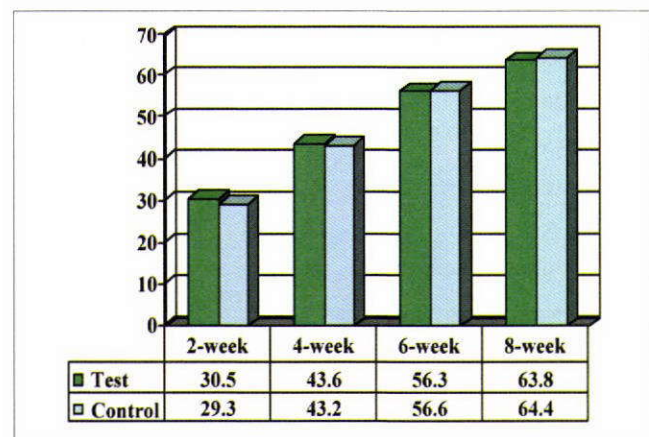


Fig. 4 Percentage reduction in gingival inflammation from baseline at 2, 4, 6, and 8-week examinations in the test and control groups (no significant differences between the test and control groups).

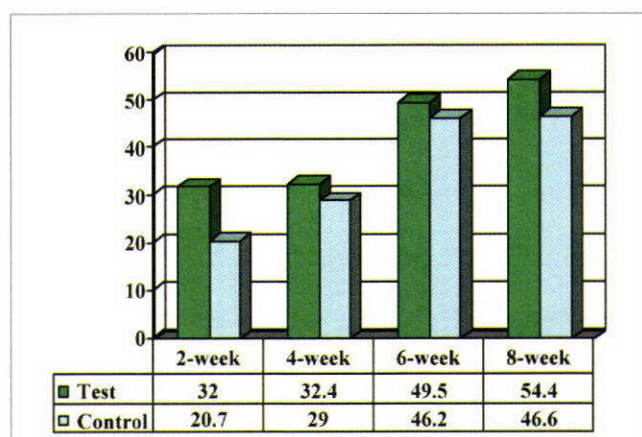


Fig. 6 Percentage reduction in gingival bleeding from baseline at 2, 4, 6, and 8-week examinations in the test and control groups (no significant differences between the test and control groups).

baseline BI scores. The test group showed greater reduction in the BI scores than the control group at 2, 4, 6, and 8 weeks, but these differences were not statistically significant.

At 8 weeks, subjects in the test and control groups exhibited no differences in BI scores (0.40 ± 0.21 vs. 0.46 ± 0.21). The test group showed greater reduction in gingival bleeding than the control group (54.4% vs. 46.6%). However these differences were not statistically significant.

Discussion

The present study showed no effectiveness of the test toothpaste over the control toothpaste in reducing plaque formation, gingival inflammation and gingival bleeding. Subjects in both groups exhibited highly significant reduction in plaque level, gingivitis and gingival bleeding in comparison to baseline status. With respect to baseline values, after 8 weeks both herbal and control toothpastes reduced plaque levels by 33% and gingival inflammation by 64%. The herbal toothpaste showed slightly greater reduction in gingival bleeding than the control toothpaste (54.4% vs. 46.6%). However, These numbers indicate no significant differences between the test and control toothpastes in the control of gingival plaque, inflammation and bleeding. Both of the test and control toothpastes contained sodium chloride and sodium bicarbonate salts. The reduction of plaque level and gingival inflammation may be benefited from the properties of these inorganic salts. Sodium bicarbonate and sodium chloride are useful for gingival health by their antibacterial effects and buffering capacity. The antibacterial properties of salt solutions are well documented in the literature. Most of their activities are based upon the osmotic pressure changes that cause bacterial cell disruption and death^{9,22}. Newbrun and co-authors²³ studied the in vitro effect of sodium bicarbonate on periodontal microorganisms and reported that all of the bacteria tested were susceptible to sodium bicarbonate. With reference to buffering capacity, the test and control toothpastes have equal alkaline pH of 9. The alkaline pH facilitates buffer action. A low salivary pH seems to favor the growth of acidic microorganisms²⁴. However, as reported by Watermann and colleagues²⁵, the effectiveness of salt-containing toothpastes in patients with gingivitis were not better than the conventional toothpaste. Also, the herbal and control toothpastes in the present study contained the same conventional ingredients. The indifferences in the

reduction of plaque level and gingival inflammation in both toothpastes may also be contributed from those conventional ingredients.

Chamomile, echinacea, myrrh and sage, herbal ingredients contained in the test toothpaste, are known of their anti-inflammatory, antimicrobial and astringent properties. These herbal ingredients theoretically may be useful in controlling plaque and gingivitis. However, in this study these herbal ingredients have not demonstrated their therapeutic effects as measured by the plaque, gingival and bleeding indices.

Since it is not clear that what ingredients in the two toothpastes exert effect on the reduction of plaque level and gingival inflammation. Further studies need to be done in order to investigate the true efficacy of the sodium chloride, sodium bicarbonate salts and the herbal ingredients contained in the toothpastes.

Conclusions

After an 8-week study period, statistically significant reductions in the plaque, gingival and bleeding indices were observed in the herbal and control groups. There were no significant differences in the measured indices between the two toothpastes examined. The herbal toothpaste was no more effective than the control toothpaste in reducing plaque and gingivitis. Thus, the present study shows no clinical benefit of the herbal toothpaste over the control toothpaste towards gingival health.

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บทวิทยาการ

ประสิทธิภาพของยาสีฟันสมุนไพรชนิดหนึ่งต่อการควบคุมคราบจุลินทรีย์และเหงือกอักเสบ

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บทคัดย่อ

การศึกษาประสิทธิภาพของยาสีฟันสมุนไพรชนิดหนึ่งต่อการควบคุมคราบจุลินทรีย์และเหงือกอักเสบโดยวิธีการที่ทั้งผู้ตรวจและผู้รับการทดสอบไม่ทราบว่าผู้รับการทดสอบใช้ยาสีฟันชนิดใด ผู้เข้ารับการทดสอบจำนวน 40 คน อายุระหว่าง 22-54 ปี แบ่งเป็นกลุ่มละ 20 คน โดยแต่ละกลุ่มจะใช้ยาสีฟันสมุนไพร หรือยาสีฟันควบคุมเป็นระยะเวลา 8 สัปดาห์ ดัชนีชี้วัดประกอบด้วยดัชนีคราบจุลินทรีย์ ดัชนีเหงือกอักเสบ และดัชนีอาการเลือดออก การตรวจและบันทึกค่าดัชนีทำที่วันก่อนเริ่มใช้ยาสีฟัน สัปดาห์ที่ 2, 4, 6 และ 8 เมื่อเปรียบเทียบกับค่าดัชนีที่วันก่อนเริ่มใช้ยาสีฟัน พบว่าทั้งกลุ่มที่ใช้ยาสีฟันสมุนไพรและยาสีฟันควบคุมที่ทุกระยะของการทดสอบสามารถลดค่าของดัชนีชี้วัดทุกตัวอย่างมีนัยสำคัญ ($p < 0.0001$) แสดงว่าทั้งยาสีฟันสมุนไพรและยาสีฟันควบคุมแสดงประสิทธิภาพในการควบคุมคราบจุลินทรีย์และลดการอักเสบของเหงือกเมื่อเปรียบเทียบกับวันก่อนเริ่มใช้ยาสีฟันไม่แตกต่างกัน ยาสีฟันสมุนไพรสามารถลดค่าของดัชนีชี้วัดทุกตัวได้มากกว่ายาสีฟันควบคุมเล็กน้อยในทุกระยะของการทดสอบ แต่ความแตกต่างนี้ไม่แสดงนัยสำคัญทางสถิติ ผลการศึกษานี้ไม่แสดงประโยชน์ที่เหนือกว่าทางคลินิกของยาสีฟันสมุนไพรเมื่อเปรียบเทียบกับยาสีฟันควบคุม

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