

Full Length Research Paper

Research on comparative evaluation of a commercially available herbal and non-herbal dentifrice on dental plaque and gingivitis in children

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Gingivitis is common in all age groups and is thought to be a non-specific inflammatory reaction to a complex indigenous microbiota. Studies indicate that the prevalence of gingivitis increases during early teenage years. Supragingival plaque control is an effective method of controlling gingivitis. Undoubtedly, the most widely practiced form of oral hygiene is tooth brushing with a dentifrice. Recently, interest in natural-based products has increased. Most of the herbal products are known to have a variety of medicinal properties. A study was conducted to evaluate plaque and gingival status in children by daily supervised tooth-brushing for a period of 21 days with commercially available herbal dentifrice in comparison with non-herbal dentifrice. 30 children between ages 8 to 10 years with full complement of dentition were subjected to the study after scaling. Plaque and gingival scores were recorded throughout the course of the study at 0, 7 and 21 days. The mean scores were subjected to statistical analyses. There was significant reduction in plaque and gingival score from day 0 to the end of the study in both groups. Though herbal dentifrice showed more effectiveness than the non-herbal dentifrice on the reduction of gingival scores, there was no statistically significant difference between the two groups.

Key words: Plaque, gingivitis, herbal dentifrice, non herbal 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 as well the periodontal disease is dependent on optimal plaque control (Axelsson et al., 1991).

The 1998 European Workshop on Mechanical Plaque Control emphasized the importance of regular oral hygiene practices. The past four decades of experimental research, clinical trials and demonstration projects in

different geographical and social settings have confirmed that the effective removal of dental plaque is essential to dental and periodontal health throughout life (Newman et al., 2003).

Interest in alternative toothpaste based on plant extracts has increased recently. Among these, herbal products namely Parodontox has received greater attention in many countries. It is composed of chamomile, Echinacea, sage, rhatany and myrrh. Studies conducted by Yankel et al. (1988) have reported that Parodontox significantly decreases plaque and gingivitis.

Certain plants used in folk medicine serve as a source of therapeutic agents having multi potential effects in addition to their antimicrobial activity. Herbal formulations can provide an option for safe and long-term use (Pradeep et al., 2009). Research in this area to generate necessary evidence is required. There has been search

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Table 1. Inter- and intra-group comparisons of herbal and non-herbal groups for plaque index.

All selected teeth	Examination day	Group				t- value	p-value
		Herbal		Non-herbal			
		Mean	SD	Mean	SD		
	0	1.69	0.42	1.67	0.34	0.14	>0.05
	7	1.22	0.3	1.38	0.29	1.49	>0.05
	21	0.67	0.22	0.67	0.22	0.02	>0.05
Overall							
	F-value	42.75		45.60			
	p-value	0.000***		0.000***			
	% reduction	60.36%		59.89%			

*p <0.05=statistically significant, **p<0.01= highly significant, ***p<0.001=very highly significant.

for years for chemical agents that could supplant patient-dependent mechanical plaque control and thus reduce or prevent oral disease (Jacob et al., 2009). Thus, an attempt is made here to compare the effectiveness of triclosan-based dentifrice and herbal based dentifrice by conducting a trial among JSS free school children at Suttur village over a period of 21 days.

MATERIALS AND METHODS

After ethical approval, sample size of 30 subjects aged between 8 to 10 years were selected for the study. The inclusion criteria included subjects of either gender, all teeth fully erupted for that age group, with a plaque index of 2 of the sites examined as measured by Turesky et al. (1970) (modification of Quigley - Hein plaque index, 1962) and gingival index of 1 as measured by Loe and Silness (1963). Caries-free mouth subjects were selected by using MØller's (1966) dental caries criteria confirmed through bitewing radiographs and interpreted by radiologist using Marthaler's et al. (1970) radiographic index. Subjects who had a known history of sensitivity or oral mucosal tissue reaction to the toothpaste's ingredients were excluded.

The study was designed as a randomized double-blinded clinical trial. The subjects were randomly assigned to either Group 1 (herbal group) or Group 2 (non-herbal group) by the random number table. After obtaining informed consent, random allocation sequence was generated and binding, allocation concealment were controlled by the co-investigator and was concealed from the main investigator. The main investigator was responsible for assessing the study variables. The toothpastes were distributed in plain white tubes identified as 'Group 1' and 'Group 2' tubes. The investigator and the study subjects were unaware of the contents of each toothpaste. The co-investigator revealed the contents of each tube only after the experiment period was over.

Subjects in Group 1 received commercially available herbal dentifrice containing 1000 ppm sodium monofluorophosphate, calcium carbonate, chamomile, eucalyptus, myrrh, sage. The subjects in Group 2 received conventional dental cream containing 1000 ppm sodium monofluorophosphate, calcium carbonate, silica, triclosan. All subjects were given toothbrushes at the beginning of the study (Plakoff, ICPA Health Products Ltd., Mumbai, India).

Prior to the commencement of the study, subjects were given professional hand scaling to render them plaque-, stain- and calculus-free after disclosing dental plaque. They were then asked to refrain from normal tooth cleaning habits. All the subjects in both groups underwent a washout period of 2^{1/2} days to rule out any

possible carryover effects of the previously used oral hygiene products (Binney et al., 1997). The washout was done by brushing with water alone and then followed by the treatment period of 21 days. No changes in their brushing habits were made. At the end of the washout period, subjects were scored for plaque and gingival indices and were taken as the baseline score (day 0). Index teeth 16, 11, 64, 36, 41 and 84 were used for scoring plaque and gingival bleeding (Mullally et al., 1995). The subjects then started the experiment period. Gingival index always followed the recording of plaque index. All measurements were conducted by the main investigator who was previously calibrated. For calibration, two measurements were performed with one-hour interval. Inter and intra examiner calibration was performed in 5 patients until an 80% agreement was obtained. After Day 0, plaque and gingival scoring, subjects were supervised for 21 days where they brushed with the assigned toothpaste twice daily. On days 7 and 21, the subjects were scored again by the same investigator.

RESULTS

Statistical analyses were performed using personal computer with SPSS (Version 16). Data comparison was done by applying specific statistical tests to find out the statistical significance of the comparisons. Statistical tests employed for the obtained data in this study were independent t-test, paired sample t-test and repeated measure ANOVA. All statistical tests employed a level of significance of = 0.05.

Intra-group comparisons of the herbal and non-herbal group using repeated measure ANOVA for plaque index showed statistically significant difference in the reduction of plaque from Day 0. After Day 21, the herbal group showed an average 60.36% reduction and the non-herbal group 59.89% reduction (Table 1).

In comparison, using independent t-test between the herbal and non-herbal groups for plaque, no statistically significant difference was obtained at Days 7 and 21 (Table 1).

On intra-group comparison using paired t-test at different time periods for plaque index, a significant reduction in plaque scores was obtained in the first week itself (Table 2).

The highest percentage reduction was achieved on the

Table 2. Surface wise comparison of mean plaque scores of all teeth in herbal and non-herbal groups.

Teeth surface	Examination day	Group				t- value
		Herbal		Non-herbal		
		Mean	SD	Mean	SD	
Buccal surface	0	1.78	0.41	1.71	0.32	0.50
	7	1.02	0.36	1.33	0.44	2.13*
	21	0.61	0.23	0.54	0.30	0.68
	F value	45.98***		41.44***		
	% reduction	65.74%		68.42%		
Lingual surface	0	1.61	0.53	1.63	0.41	0.13
	7	1.42	0.44	1.43	0.26	0.08
	21	0.73	0.28	0.80	0.27	0.67
	F value	19.27***		27.80***		
	% reduction	54.66%		50.92%		

*p value <0.05 = statistically significant, **p value <0.01= highly significant, ***p value <0.001=very highly significant.

Table 3. Inter- and intra-group comparison of mean plaque scores of maxillary and mandibular arches at Days 0, 7 and 21.

Arch	Examination day	Group				t-value
		Herbal		Non-herbal		
		Mean	SD	Mean	SD	
Maxillary arch	0	1.77	0.51	1.74	0.41	0.13
	7	1.26	0.62	1.51	0.39	1.35
	21	0.52	0.27	0.64	0.33	1.11
	F value	29.87***		32.17***		
	% reduction	70.62		63.22		
Mandibular arch	0	1.62	0.41	1.60	0.36	0.16
	7	1.17	0.27	1.27	0.48	0.71
	21	0.82	0.25	0.68	0.20	1.74
	F value	24.01***		23.25***		
	% reduction	49.38		57.5		

*p value<0.05=statistically significant, **p value<0.01= highly significant, ***p value<0.001=very highly significant.

buccal surface (65.74%) when compared with the lingual surface (54.66%) in herbal group. All the F-values obtained were found to be highly significant ($p < 0.001$). As in the herbal group, the non-herbal group also showed the highest percentage of reduction in the buccal surface (68.42%) than the lingual surface (50.92%). No group difference existed and no interaction effect existed between the groups at Days 0, 7 and 21 since all the t-values obtained were found to be non-significant for both surfaces except at Day 7 in the herbal group being significantly lower than the non-herbal for the buccal surfaces (Table 2).

Intra group comparisons of the mean plaque scores for the maxillary arch over a time period of 21 days were subjected to repeated ANOVA measure found to be significantly lower ($p < 0.001$) in both the herbal and non-herbal

groups. Similarly, the mandibular arch mean plaque scores were also significantly lower ($p < 0.001$) in both the herbal and non-herbal groups at Days 7 and 21 when compared to the 0 day (Table 3).

On intergroup comparison, though the plaque scores were lower in the herbal group only at Day 7 in both the arches, a non-significant difference was seen at the follow up days (7 and 21) among the herbal and non-herbal groups. The highest percentage reduction was achieved in the maxillary arch (70.62 and 63.22%), followed by the mandibular arch (57.5 and 49.38%) in herbal and non-herbal groups, respectively. Though, the herbal group showed a better reduction in the maxillary arch and the non-herbal group showed more reduction in the mandibular arch after Day 7 day, the difference between the two groups was not statistically significant (Table 3).

Table 4. Inter- and intra-group comparisons of herbal and non-herbal groups for gingival index.

All selected teeth	Examination day	Group				t-value	p-value
		Herbal		Non-herbal			
		Mean	SD	Mean	SD		
	0	0.81	0.18	0.72	0.10	1.68	>0.05
	7	0.67	0.11	0.62	0.14	1.18	>0.05
Overall	21	0.41	0.11	0.43	0.09	0.51	>0.05
Gingival score	F-value	36.94		28.08			
	p-value	0.000***		0.000***			
	% reduction	49.38		40.28			

*p <0.05=statistically significant, **p <0.01= highly significant, ***p <0.001=very highly significant.

Table 5. Intra-group comparison and paired t-test at different time periods for gingival and plaque indices.

All selected teeth		Days 0 to 7		Days 0 to 21		Days 7 to 21	
		Herbal	Non-herbal	Herbal	Non-herbal	Herbal	Non-herbal
Overall gingival bleeding score	t-value	2.960**	2.93**	7.181***	7.60***	7.072***	4.30***
Overall plaque score	t-value	4.64***	2.80**	8.49***	9.10***	5.05***	6.48***

*p<0.05=statistically significant, **p<0.01= highly significant, ***p<0.001=very highly significant.

Intragroup comparisons of the herbal and non-herbal groups using repeated measure ANOVA on the mean gingival scores showed statistically significant difference from Days 0 to 21. On Day 21, an average of 49.38% reduction was seen in the herbal group whereas, it was 40.28% reduction in the non-herbal group (Table 4). On comparison, using independent t-test between the herbal and non-herbal mean gingival scores, no statistically significant difference was obtained among any of the recorded days (Table 4). On intragroup comparison, using the paired t-test at different time periods for gingival index score, significant reduction in the gingival score was observed in the first week itself (Table 5).

Intragroup analysis of the mean gingival scores for maxillary and mandibular arches on being subjected to repeated measure ANOVA were found to be significantly lower in both the herbal and non-herbal groups at Days 7 and 21 when compared to the 0 day (Table 6). The highest percentage reduction was achieved in the herbal group (51.19 and 45.45%) followed by non-herbal group (43.59 and 36.76%) in maxillary and mandibular arches respectively (Table 6).

DISCUSSION

A thorough exploration of available literature revealed very few studies in which different herbal dentifrices were compared with fluoride-containing dentifrice and triclosan dentifrice on children. The principal ingredients in the herbal dentifrice used have several medicinal properties.

Chamomile is supposed to have anti-inflammatory properties and to decrease gingival inflammation. Sage is believed to have anti-bacterial, -fungal and -viral effects and anti-hemorrhagic properties. Myrrh is claimed to be a natural antiseptic with strong cleaning and healing properties and anti-inflammatory and analgesic properties and eucalyptus adds on as an aromatic stimulant and antiseptic (Mullaly et al., 1995).

The difference in mean dental plaque scores between Days 0 to 21 were found to be statistically very highly significant (p<0.001) in both groups for maxillary and mandibular arches. However the differences between the groups were not statistically significant. The mean gingival bleeding scores also showed a statistically significant decrease between Days 0 to 21 in both herbal and non-herbal groups. The difference between the two groups was not statistically significant.

Our study is in agreement with studies by Saxer et al. (1995) and Mullaly et al. (1995) which showed there is significant reduction in both plaque and gingival indices within the group but no significant difference between the groups when herbal dentifrice were used. A study by Pannuti et al. (2003) was unable to show a significant reduction in plaque and gingivitis when compared to a standard dentifrice. In the present study, the possible reason for a reduction in plaque in the first week itself in both herbal (p<0.001) and non-herbal groups (p<0.01) may be attributed to the fluoride content in the dentifrice and supervised brushing that was followed throughout the study. The role of herbal products alone needs to be further evaluated to know its role in plaque reduction.

Table 6. Inter and intra group comparisons of mean gingival bleeding scores of maxillary and mandibular arch at Days 0, 7 and 21.

Arch	Examination day	Group				t-value
		Herbal		Non-herbal		
		Mean	SD	Mean	SD	
Maxillary arch	0	0.84	0.21	0.78	0.10	1.00
	7	0.71	0.19	0.56	0.14	2.48*
	21	0.41	0.18	0.44	0.12	0.59
	F	23.68***		33.79***		
	% reduction	51.19		43.59		
Mandibular arch	0	0.77	0.21	0.68	0.15	1.41
	7	0.64	0.17	0.63	0.17	0.18
	21	0.42	0.10	0.43	0.11	0.44
	F value	24.16***		11.47***		
	% reduction	45.45		36.76		

*p value<0.05=statistically significant, **p value <0.01= highly significant, ***p value <0.001=very highly significant.

Concurrently, the reduction in gingival bleeding and inflammation was also noted to be significant in the first week itself in both groups. Though there was no significant difference between the groups, the herbal group showed considerable decrease in gingival bleeding and inflammation than the non-herbal group. The possibilities could be due to the ingredients in the herbal dentifrice which contained more of anti inflammatory and astringent properties. These were lacking in the non-herbal group. These ingredients in the former had an added advantage in addition to plaque reduction. Thus, plaque reduction and restoration of gingival health can be obtained within a week especially when supervised toothbrushing is followed.

In conclusion, herbal dentifrice when compared to the non-herbal dentifrice has more benefit over restoring gingival health besides plaque formation reduction. Therefore, herbal dentifrice definitely is an alternative in restoring gingival health for those using herbal products.

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