

“Evaluation of Additional Antiplaque and Antigingivitis effect of Mouth rinse and Dental Floss on routine Manual tooth brushing”

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Abstract

Objectives: The present study was conducted to determine the additional plaque and gingivitis reduction achieved by mouthrinse and floss, when used individually as adjuncts to routine manual tooth brushing.

Material and Methods: This randomized, examiner blind, parallel 3-cell study was conducted over a period of two months. At the initial visit, the gingival and plaque scores of 90 adult subjects were recorded using Loe and Silness Gingival index and Turesky, Gilmore, Glickman modification of Quigley Hein plaque index respectively. This was followed by a random allocation of the study subjects into 3 groups: toothbrush toothpaste; toothbrush toothpaste and mouthrinse; and toothbrush toothpaste and floss. Oral prophylaxis and the respective products were provided to all the study subjects, who were subsequently recalled after 15 days, 1 month and 2 months for gingival and plaque examinations using the above mentioned indices.

Results: At the end of 2 months, the mouthrinse and the floss groups showed 42.61% and 37.63% reduction in the mean plaque scores respectively as compared to 17.98% reduction in the toothbrush tooth paste group. The percentage reductions in the mean gingival scores among the mouthrinse and floss groups were 40.09% and 37.62% respectively as compared to the toothbrush toothpaste group which showed 31.43% of reduction. The difference was statistically significant ($P < 0.05$).

Conclusion: An additional 24.67% and 19.6% of plaque reductions and 8.95% and 5.94% of gingivitis reductions were contributed by mouthrinse and floss respectively to the routine manual tooth brushing.

Keywords: Plaque, Gingivitis, Mouthrinse, Floss, Manual tooth brushing

Introduction

One of the pleasures that can be derived from practicing dentistry is the possibility of preventing much of the dental diseases seen in patients by a cost-effective measure.¹

The major oral diseases like dental caries and inflammatory periodontal diseases are plaque related and arise at sites where plaque is abundant and stagnant.²

Bacterial plaque plays a primary etiological role in the initiation and progression of two major inflammatory diseases of the periodontium, namely gingivitis and periodontitis. While gingivitis is the inflammation of the gingiva that does not result in clinical attachment loss, periodontitis is the inflammation of the gingiva and the adjacent supporting tissues, characterised by loss of connective tissue attachment and alveolar bone.³

Improved control of bacterial plaque is both necessary to maintain oral health and, to the individual, socially desirable.⁴ Many methods have been employed for plaque removal which includes various types of toothbrushes, dental floss and wood sticks. Mechanical tooth cleaning by means of tooth brush and a fluoridated tooth paste is almost universal.⁵

Studies have shown that approximately 60% of the plaque was left even after brushing for a minimum duration of 1 minute and that an average person brushes for less than a minute which may not be adequate for optimal level of plaque removal.⁶

The concept of mouth rinsing as an oral hygiene measure dates back to 2700 BC.⁷ A variety of ingredients

and combinations have been used since then including mixtures of betel leaves, camphor, and cardamom or other herbs; a mixture of salt, alum and vinegar; and anise, dill and myrrh in white wine. Recently, the use of therapeutic antimicrobial mouth rinses has been based on a well - documented scientific and clinical rationale.⁸

Ample of studies are conducted on the anti-plaque and anti-gingivitis roles of the various products entering into the market.⁹

However, there is paucity of knowledge regarding the additional benefit contributed individually by mouthrinse and floss as adjuncts to routine manual tooth brushing in plaque and gingivitis reductions. Therefore, this study was conducted as a means of building on this body of evidence, to determine the additional antiplaque and antigingivitis benefit if any, of mouthrinse and dental floss when used individually as adjuncts to routine manual tooth brushing.

Materials and Methods

Study Design: The present study was a randomized, observer blind, 3-cell parallel design clinical study which was conducted in Hubli Dharwad city.

Ethical Clearance: Prior to the start of the study, a protocol of the intended study was submitted to the Ethical Review Committee, S. D. M. College of Dental Sciences & Hospital, Dharwad. Ethical clearance was obtained for the present study by the aforementioned Ethical Review Committee.

Study Population: The present study was conducted in Hubli- Dharwad city. 90 healthy subjects, belonging to both genders, ranging from 18-49 years of age, who met the inclusion/exclusion criteria and who signed an informed consent form were taken in to the study and their demographics were recorded.

Inclusion criteria:

- A minimum of 20 sound natural teeth with facial and lingual scorable surfaces.
- Willingness to read, understand and sign the informed consent form.
- Male and Female subjects aged between 18 to 49 years in good general health.
- Subjects with good periodontal health with pockets < 6mm.
- A Gingival Index score of >1.0
- A Plaque Index score of > 1.5
- Availability for the entire study duration

Exclusion criteria:

- History of allergies to dental products or their ingredients.
- Gagging reflexes that prevent oral examination.
- Orthodontic appliance or any kind of fixed or removable appliances.
- History of diabetes, hepatic, renal disease or other serious medical condition and transmissible disease.
- Destructive periodontal disease.
- Significant soft tissue pathology, systemically related gingival enlargement/ severe gingivitis.
- Pregnant and breast feeding women.
- Undergoing antibiotic, steroid therapy or any anti-inflammatory drugs in the preceding month.
- Oral prophylaxis in the preceding month or periodontal treatment in the preceding 3 months or participation in any other plaque and gingivitis clinical study involving oral care products within the last 30 days.
- History of adverse habits like smoking and tobacco chewing

Study Products: For the purpose of standardization, the study subjects in all the three groups received a fluoride tooth paste, Colgate Cavity Protection (Colgate Regular) and a medium bristled tooth brush. In addition to this, group II or the mouthrinse group received Colgate Plax fresh mint rinse and group III or the floss group received dental floss (Gum eez-thru flossers-mint) along with the toothbrush and toothpaste.

Prohibited /allowable medications or precautions:

The use of any other mouth rinse, dentifrice or oral hygiene devices other than the test materials during the study period was prohibited.

Instructions to subjects: For the purpose of standardization, a common brushing technique, i.e., modified Bass technique was taught to all the study subjects.

- The subjects were required to use the allocated mouth rinses/ flosses regularly as per instructions
- The subjects were required to brush twice daily for a duration of two minutes each
- The subjects were instructed not use any other type of oral hygiene aids during the period of the study.

Instructions to use mouth rinses: 30 mins after toothbrushing, the subjects of the mouthrinse group were asked to rinse with 20ml of Colgate Plax freshmint mouth rinse for 30 seconds (in the morning and in the night). During this study, subjects were instructed to refrain from using other commercial mouth rinses and any other medications. Further, the subjects were informed that, any loss of the issued mouth rinse has to be reported to the personnel on his subsequent visit.

Instructions to flossing: The dental flossing was demonstrated and it did not exceed 2 minutes. Apart from the routine manual toothbrushing, the subjects in the floss group were instructed to floss once a day before going to bed with five cleaning strokes in each proximal surface to standardize the flossing time.

Screening visit and subject selection: Adult subjects who fulfilled the inclusion exclusion criteria and who signed the informed consent form were enrolled in the present study.

Oral soft tissue and hard tissue examination: All subjects received an evaluation of their soft and hard tissues in the initial visit. This examination included an evaluation of the soft and hard palate, gingival mucosa, buccal mucosa, mucogingival fold areas, tongue, sublingual, submandibular areas, tonsillar, pharyngeal areas and teeth.

Plaque and gingival assessment: On the initial visit, the gingival and the plaque status of the study subjects were assessed by a single calibrated examiner using the Loe and Silness gingival index (Talbot et al. modification) and Turesky, Gilmore, Glickman modification of Quigley- Hien Plaque index respectively.

The subjects were recalled after 15 days, 1 and 2 months usage of the assigned oral hygiene products, and were evaluated by the same calibrated dental examiner for gingival and plaque index scores using the same above mentioned indices. Data was recorded on the examination form. Soft tissue examination was also done to look for any adverse changes attributable to usage of products.

Statistical Analysis

The data was entered into the computer (MS-Office 2007, Excel data sheet). The data was subjected to statistical analysis using the statistical package (SPSS version 20). For the inter-group comparison of the plaque and gingival index scores among the 3 groups, statistical significance was recorded if the P-value was 0.05 or less.

The mean plaque and gingival scores of the baseline, 15 days, one month and 2 months were compared in each group by paired t test and the three groups were compared using One Way ANOVA at initial visit, 15 days, 1 month and 2 months with respect to their plaque and gingival scores followed by Scheffe post hoc test for pairwise comparison.

Results

Table 1: Study duration and distribution of study subjects in three oral hygiene regimen groups with percentage drop outs in each group

Study Groups	Oral hygiene regimens	Subjects at the beginning of study period (n)	Duration of study (weeks)	No. of study subjects at end of study period (n)	No. of dropouts	% of drop outs
Group 1	Toothbrush toothpaste group	30	8	26	4	13.33%
Group 2	Mouth rinse group	30	8	28	2	6.67%
Group 3	Floss Group	30	8	29	1	3.33%
Group 4	N	90	8	83	7	7.78%

Table 1 shows the study period, distribution of study subjects at the beginning and at the end of the study period and also the number of dropouts during the study in each of the three groups. A total of 90 subjects were included in the present study and were randomly allocated into the following three groups of 30 each. Group I: Tooth brush tooth paste group; Group II: Mouth rinse group (mouthrinse used as an adjunct to toothbrushing); Group III: Floss group (floss used as an adjunct to toothbrushing). The study subjects were followed for a period of 8 weeks after issuing the respective products. At the end of the study period, a total of 83 study subjects were available for follow up, with an overall attrition rate of 7.78% (n = 7). The number of drop outs were 4 (13.33%) in the toothbrush tooth paste group, 2(667%) in the mouthrinse group and 1(3.33%) in the floss group.

Table 2: Comparison of mean Plaque and gingival scores among the three groups at the initial visit using One Way ANOVA

Study Groups		Indices	
		Plaque Index Mean±SD	Gingival Index Mean±SD
Toothbrush & toothpaste		3.00±0.44	1.81±0.34
Mouthrinse		3.07±0.46	1.83±0.41
Floss		2.95±0.46	1.79±0.40
ANOVA	FP	0.448	0.060
		0.640	0.942

SD- Standard Deviation

Table 2 Shows the mean baseline plaque scores and the mean baseline gingival scores in the three groups. The mean baseline plaque scores at baseline ranged from 3.07±0.46 in the mouthrinse group to 2.95±0.46 in the floss group. The baseline gingival scores ranged from 1.83±0.41 in the mouthrinse group to 1.79±0.40 in the floss group. One way ANOVA showed that there was no statistically significant difference between the three groups with respect to the mean plaque and gingival scores at baseline (P> 0.05).

Table 3: Comparison of mean Plaque and gingival scores among the three groups at 15 days using One Way ANOVA

Study Groups		Indices	
		Plaque Index Mean+SD	Gingival Index Mean+SD
Toothbrush & toothpaste		2.31±0.39	1.33±0.23
Mouthrinse		2.44±0.41	1.34±0.22
Floss		2.39±0.42	1.35±0.28
ANOVA	FP	0.686 0.507	0.077 0.926

SD- Standard Deviation

Table 3 shows the mean plaque and gingival scores in the three groups at 15 days. The mean plaque scores at 15 days in all the three groups reduced ranging from 2.31±0.39 in the toothbrush toothpaste group to 2.44±0.41 in the mouthrinse group. The gingival scores also showed reduction on the 15th day with the mean gingival scores of 1.35±0.28 in the floss group, 1.34±0.22 in the mouthrinse group and the 1.33±0.23 in the toothbrush toothpaste group. One way ANOVA showed that there was no statistically significant difference between the three groups with respect to the plaque and gingival scores at 15 days ($P>0.05$).

Table 4: Mean Plaque Index, and gingival Index scores of study groups at 1 month

Study Groups		Indices	
		Plaque Index Mean+SD	Gingival Index Mean+SD
Toothbrush & toothpaste		2.36±0.34	1.24±0.16
Mouthrinse		1.99±0.40	1.17±0.17
Floss		1.99±0.40	1.16±0.18
ANOVA	FP	8.156 0.001	1.440 0.243

SD- Standard Deviation

It is observed from the **Table 4** that the mean plaque scores in the mouthrinse and floss groups at 1 month reduced further to 1.99±0.40 and 1.99±0.40 respectively. Whereas, the mean plaque scores in the toothbrush toothpaste group slightly increased to 2.36±0.34. One way ANOVA showed that there was highly statistically significant difference between the three groups with respect to the mean plaque scores at 1 month ($P<0.001$). Also, the mean gingival scores reduced further in all the three groups. It was 1.24±0.16 in the toothbrush toothpaste group, 1.17±0.17 in the mouthrinse group and 1.16±0.18 in the floss group. One way ANOVA showed that there was no statistically significant difference between the three groups with respect to the gingival scores ($P>0.05$).

Table 5: Mean Plaque Index and gingival Index scores of study groups at 2 months

Study Groups		Indices	
		Plaque Index Mean+SD	Gingival Index Mean+SD
Toothbrush & toothpaste		2.46±0.40	1.24±0.21
Mouthrinse		1.76±0.41	1.09±0.18
Floss		1.84±0.38	1.12±0.20
ANOVA	FP	24.586 0.000	4.297 0.017

D- Standard Deviation

Table 5 shows the mean plaque scores at 2 months in the mouthrinse and floss groups showed further reductions to 1.76±0.41 and 1.84±0.38 respectively. But, the mean plaque score in the toothbrush toothpaste group increased to 2.46±0.40. One way ANOVA showed that there was a highly statistically significant difference between the three groups with respect to the mean plaque scores at 2 months ($P<0.05$).

Gingival scores at two months in the toothbrush toothpaste group was almost similar to the one month score which was around 1.24±0.21, and the gingival scores in the mouthrinse and floss groups reduced to 1.09±0.18 and 1.12±0.20 respectively. One way ANOVA showed that there was statistically significant difference between the three groups with respect to the gingival scores at 2 months ($P<0.05$).

Discussion

Dental caries and periodontal disease are the most commonly occurring diseases affecting mankind. Dental plaque is a very important factor in the causation of both these diseases. There is a general agreement that a positive correlation exists between bacterial plaque on the tooth surfaces and gingival inflammation. The strong association of plaque with gingivitis was revealed in several epidemiological Surveys.¹⁰ Realistically, these diseases are kept at bay through personal and professional oral hygiene measures.

A variety of rudimentary products and devices were used in the ancient times, like chewing sticks, tree twigs, bird feathers, animal bones, tooth powder and home-made mouth rinses. Today, due to technological improvements of the cosmetic industry and market competition, home-use oral care products available in the marketplace offer a great variety of options. An increase in the consumption of oral care products has been observed in the last decades.¹¹

The study was conducted among the adult population of Hubli- Dharwad city aged between 18-49 years, who fulfilled the inclusion and exclusion criteria and who signed the consent form. After reviewing the relevant literatures and conducting a pilot study, a biostatistician was consulted and the total sample size

of 72 (24 per treatment group) was determined. Since it was a follow up study and drop outs were inevitable, a total of 90 subjects were enrolled who were selected randomly and were balanced based on their age and the baseline plaque scores into three treatment groups of 30 each. The reason for balancing based on their initial plaque scores and not their gingival scores was that the gingival scores were dependent on the plaque scores.

Two of the study subjects from the mouth rinse group reported burning sensation and desquamation of the oral mucosa. This could be attributed to the high alcohol content of the mouth rinse (95% ethyl alcohol) or may be due to the active ingredient cetyl peridinium itself. These subjects were excluded from the final analysis.

The plaque index of Quigley and Hein (1962) modified by Turesky et al (1970) was used for quantification of dental plaque due to the number of scores of the index. This allowed the evaluation of slight changes in the amount of dental plaque and has been used extensively in various trials evaluating the efficacy of oral hygiene regimens. The gingival inflammation was assessed according to the Loe and Silness gingival index (modified) since it is the most widely accepted and used gingival index due to its documented validity, reliability and ease of use.

In this study it also appears that a single oral hygiene instruction, describing the use of mechanical tooth brush, in addition to a single professional oral prophylaxis provided at the initial visit had a significant, positive effect on the reduction of plaque and gingivitis.

There was no statistically significant difference in the plaque scores among the three groups at 15 days. Results of paired t test showed that all the 3 groups showed significant reductions in the plaque scores from baseline to 15 days with percentage plaque reduction in toothbrush toothpaste group being 23.18%, mouth rinse group showing 21.21%, and the floss group with 17.98% from baseline to 15 days. This could be attributed to the oral prophylaxis provided to all the subjects at baseline.

The tooth brush tooth paste group, although not significant, showed an increase of 2.57% in the mean plaque score from 15 days to 1 month. Whereas the mean plaque scores in the mouth rinse group and the floss group showed further significant reduction of 18.18% and 16.39% respectively. The three groups thus differed significantly at 1 month with $p = 0.001$.

It is seen in the present study that although not significant, the mouth rinse group has shown greater plaque reduction than the floss group. This could be due to the fact that mechanical plaque control procedures concentrate solely on the hard surfaces of the oral cavity while the chemical antiplaque agents reach the soft tissue surfaces improving the control of biofilm growth on these surfaces and delaying microbial accumulation on teeth and hence retards the plaque accumulation on tooth surfaces better¹².

In the present study, the floss group also achieved a greater plaque reduction of 19.6% as compared to the toothbrush toothpaste group. This is in accordance with a study conducted by Terézhalmy GT et al¹⁵, that used the Rustogi modified Navi plaque index and Turesky et al modification of Quigley and Hein plaque index and showed that floss provided 16.4-26% of greater plaque reduction than the manual tooth brush. The Benefits of flossing could be due to greater mechanical disruption of interproximal dental plaque biofilm than does brushing alone, with the clinical outcome being a greater reduction in plaque and gingivitis. It can also remove trapped food debris.¹⁶

Over all changes in the plaque scores from baseline to 2 months in the three groups were as follows: The total mean plaque scores in the tooth brush tooth paste group reduced from 3.0076 at baseline to 2.4669 at the 2nd month recall visit which is a reduction of 17.98%. Whereas, the mouthrinse group showed a reduction of 42.61% the floss group showed a reduction of 37.63%. This indicates that mouth rinse contributed to an additional reduction of 24.63% in plaque compared to manual tooth brushing. Similar finding was seen in a 6 month trial conducted by Allen et al¹⁷ where in there was a reduction of 28.2% in QHI (Quigley Hein Index) after rinsing twice a day with a 0.05% CPC mouth rinse Vs a placebo.

The data of the present study clearly show that in addition to tooth brushing, rinsing with an antibacterial mouth rinse and flossing is more effective in reducing plaque than tooth brushing alone.

This present study shows the impact of dental floss and mouth rinse on individual who are strongly motivated and brush their teeth efficiently. Although Dental floss seems to be efficient in removing plaque, it is also dependent on the factors such as motivation and dexterity of the individuals, which may reduce over time. An important consideration is the role of compliance because flossing frequency, duration and technique are recognized to influence the real world results³⁴.

However in a controlled setting, dental floss may show a comparable ability to remove plaque.

Nevertheless it is reasonable to question whether in an extended study, conditions would continue to improve or lapse towards previous levels as well as whether the relative differences between the groups would remain the same.

Conclusions

- a. Mouthrinse and floss contributed to greater plaque and gingivitis reductions when used as adjuncts to routine manual toothbrushing.
- b. The mouthrinse was shown to be as good as flossing in reducing plaque and gingivitis. So, the findings of this study provide evidence for the beneficial effect of mouthrinse and floss in enhancing the plaque reduction achieved by the

- mere usage of the mechanical oral hygiene regimen viz., toothbrushing with dentifrice.
- c. As flossing and rinsing are shown to have additional benefit in plaque and gingivitis reduction, oral health education programmes should include the demonstrations and constant reinforcement of even flossing and rinsing techniques along with the usual brushing techniques.
- d. Professional recommendations to floss and rinse daily should continue to be reinforced.

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