

Comparative Study on the Efficacy of Interdental Brush and Dental Floss in Interdental Plaque Reduction among Undergraduate Students in a Dental Institute in North Bangalore

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Received: August 07, 2024; **Published:** September 16, 2024

Abstract

Introduction: Effective oral hygiene is crucial for maintaining good oral health, impacting overall health and quality of life. Dental plaque accumulation is a primary factor for periodontal disease, characterized by an inflammatory response in gingival tissue. While brushing is the most practiced method, it is less effective for interproximal surfaces, necessitating additional interdental aids like dental floss and interdental brushes. Dental students, as future oral health professionals, are an ideal study population for assessing these methods.

Methodology: A parallel group randomized control trial was conducted among 45 dental students in North Bangalore over three months. Participants were randomly assigned to three groups: Group 1 (dental floss and manual brushing), group 2 (color-coded interdental brushes and manual brushing), and group 3 (manual brushing only, control group). Ethical clearance and informed consent were obtained. Interventions lasted five weeks, with oral prophylaxis provided before the interventions. Measurements were taken at baseline, 14 days, and 28 days using full mouth plaque score (FMPS), full mouth bleeding score (FMBS), and papillary bleeding index (PBI).

Results: The study included 45 participants, with no significant age or gender differences among groups. Significant differences in FMBS were observed at 14 and 28 days, with group 2 showing the lowest scores. PBI scores were significantly lower in group 2 at 14 and 28 days. Interdental brushes were more effective than dental floss and manual brushing alone in reducing interdental plaque and bleeding scores.

Conclusion: Interdental brushes, selected based on each patient's specific interdental spaces using a colorimetric probe and combined with manual tooth brushing, were more effective in reducing interdental plaque and bleeding compared to dental floss or manual brushing alone. These findings underscore the importance of integrating interdental aids into daily oral hygiene routines for optimal oral health.

Keywords: Interdental Brushes; Dental Floss; Dental Students; Colorimetric Probe; FMBS; FMPS; Papillary Bleeding Index

Introduction

Effective oral hygiene is a crucial factor in maintaining good oral health, which is associated with overall health and health-related quality of life [1,2]. Accumulation of dental plaque is undoubtedly the main aetiological factor associated with the most frequent diseases of the oral cavity [3]. Oral biofilm, commonly known as dental plaque has been defined as the diverse microbial community found on the tooth surface embedded in a matrix of polymers of bacterial and salivary origin [4]. The presence of dental plaque is the primary etiological factor in the development of periodontal disease, which is defined as an inflammatory response in the gingival tissue [5,6]. It is thus of utmost importance to be able to manage plaque accumulation through successful prevention strategies.

Studies showed that dental plaque is accumulated differently, in a specific pattern, among the individuals, yet the interproximal areas appear to be consistently associated with higher plaque scores [7,8]. Brushing is the most practiced oral hygiene method for plaque removal [9]. However, brushing is also thought to be more optimal for cleaning facial surfaces of teeth compared to interproximal surfaces. Conventional toothbrushes are not capable of reaching the proximal surfaces as effectively as the buccal, lingual, and occlusal surfaces, nor can they reach the interproximal areas of adjacent teeth [10]. The interdental areas are hard to access with a toothbrush, thus preventing effective cleaning and allowing the formation of plaque. Therefore, additional methods have been used to assist in controlling plaque in places with difficult access. To aid in plaque control, various interdental cleaning aids are used. These include dental floss, wood sticks, interdental brushes, single-tufted brushes, rubber-tip stimulator, and irrigating devices [9].

The use of dental tape as an adjunct to brushing provides a greater benefit for disrupting biofilm, especially in the interproximal region [11,12]. Despite the high patient acceptance of daily toothbrushing, there is lower acceptance of dental flossing due to its challenging nature. The other commonly known interdental aid is the interdental brush, which is a small cylindrical or cone shaped brush that is inserted interproximally to remove the dental plaque.

Interdental brushes have been identified as a potential, suitable alternative to dental floss for interdental cleansing in other studies [11,13]. For dental students, who are future oral health professionals, maintaining exemplary oral hygiene is critical [14]. One of the main objectives of dental education is to train students who can motivate patients to adopt good oral hygiene practices. They are more likely to be able to do this if they are motivated themselves. However, little attention has been paid to the context in which dental students undergo motivational and behavioural changes concerning their oral self-care regimes. Hence, dental students are chosen as the study population for the given study. The present study was conducted to compare the efficacy of interdental brushes and dental floss in reducing interdental plaque among dental students in North Bangalore.

Methodology

A parallel group randomized control trial was conducted to evaluate the efficacy of interdental brushes and dental floss in reducing interdental plaque among dental students in North Bangalore. The study was single-blinded and spanned a duration of 3 months. Ethical clearance was obtained from the Ethical Review Committee of Krishnadevaraya College of Dental Science, Bengaluru, and written informed consent was secured from all participants.

A total of 45 dental students were randomly assigned using lottery method into three groups by principal investigator:

- Group 1 utilized dental floss combined with manual brushing,
- Group 2 used colour-coded interdental brushes which were provided as per their interdental space, this was checked using calorimetric probe, which was inserted fully into the interdental spaces and then noting the colour that appears in the interdental space in the vestibular side. The interdental brushes were assigned alongside manual brushing.
- Group 3, the control group, continued with manual brushing alone.

The sample size for each group was determined based on the following formula:

$$n = 2$$

Where:

$$Z_{\alpha/2} = \text{Type I error (5\%)} = 1.96,$$

$$Z_{\beta} = \text{Type II error (20\%)} = 0.84,$$

$$SD = \text{Standard deviation} = 10.2,$$

$$d_1 - d_2 = \text{Difference in mean} = 11.8.$$

Inclusion criteria required participants to be healthy adults without significant dental anomalies, systemic diseases, or adverse oral habits. Exclusion criteria included ongoing orthodontic treatment, a history of periodontal disease, or recent antibiotic prophylaxis within 15 days prior to the study.

The interventions involved training participants in the use of dental floss or interdental brushes and providing these tools accordingly. The control group maintained their standard brushing routine. The intervention took place for 5 weeks. The study involved an oral prophylaxis for all participants before the interventions, with measurements taken at baseline (one-week post-prophylaxis [to provide healing of gingiva]), 14 days, and 28 days.

The effectiveness of the interventions was assessed using the full mouth plaque score (FMPS), full mouth bleeding score (FMBS), and papillary bleeding index (Saxer and Muhlemann). Data were analyzed using SPSS version 26.0. Descriptive statistics were calculated, and inferential statistics, including Kruskal-Wallis test, Dunn's post-hoc test, Friedman's test, and Chi-square test, were employed to determine differences between groups. Statistical significance was set at a 5% level.

Results

The study included a total of 45 participants, divided into three groups of 15 each. The mean ages were as follows: Group 1 (23.53 ± 2.24 years), group 2 (23.72 ± 0.74 years), and group 3 (23.22 ± 0.78 years), with no significant difference in age among the groups ($p = 0.65$). The gender distribution was 40% males and 60% females in group 1, 53.4% males and 46.6% females in group 2, and 66.7% males and 33.3% females in group 3, with no significant differences ($p = 0.65$). Significant differences in full mouth bleeding score (FMBS) were observed among the groups at 14 and 28 days. At 14 days, group 2 had the lowest FMBS (0.04 ± 0.04), followed by group 1 (0.07 ± 0.04) and group 3 (0.15 ± 0.03), with a significant difference ($p = 0.01$). By 28 days, group 2 continued to have the lowest FMBS, with significant differences observed between all groups ($p = 0.01$). Intra-group comparisons revealed significant reductions in FMBS over time for Groups 1 and 2.

The papillary bleeding index (PBI) showed significant reductions in scores, particularly in group 2 (0.10 ± 0.18) at 14 days compared to groups 1 (0.40 ± 0.31) and 3 (0.61 ± 0.22), with $p = 0.006$. By 28 days, group 2 maintained significantly lower PBI scores, indicating superior performance in reducing papillary bleeding.

The study demonstrated that interdental brushes are more effective than dental floss and manual brushing alone in reducing both interdental plaque and bleeding scores. The significant reduction in full mouth bleeding score and papillary bleeding index among the groups highlights the importance of including interdental cleaning tools in daily oral hygiene routines for better dental health outcomes.

	Group 1 (Manual Brushing + Dental Floss)	Group 2 (Manual Brushing + Interdental Brush)	Group 3 (Manual Brushing + Control Group)	P Value (Kruskal Wallis)
Mean age	23.53 ± 2.24	23.72 ± 0.74	23.22 ± 0.78	0.65

Table 1: Mean age of the study population

**P* < 0.05 Is Statistically Significant (Kruskal Wallis test).

Time Interval	Group 1	Group 2	Group 3	p-Value
Baseline	0.10 ± 0.04	0.09 ± 0.05	0.12 ± 0.11	0.65
14 Days	0.07 ± 0.04	0.04 ± 0.04	0.15 ± 0.03	0.01*
28 Days	0.05 ± 0.04	0.01 ± 0.05	0.12 ± 0.10	0.01*

Table 2: Full mouth plaque score (FMPS).

*Significant difference (*p* < 0.05).

Time Interval	Group 1	Group 2	Group 3	p-Value
Baseline	0.57 ± 0.36	0.38 ± 0.30	0.59 ± 0.21	0.43
14 Days	0.40 ± 0.31	0.10 ± 0.18	0.61 ± 0.22	0.006*
28 Days	0.35 ± 0.26	0.17 ± 0.42	0.47 ± 0.19	0.001*

Table 3: Full mouth bleeding score (FMBS).

*Significant difference (*p* < 0.05).

	Group 1 (Manual Brushing + Dental Floss)	Group 2 (Manual Brushing + Interdental I Brush)	Group 3 (Manual Brushing +Control Group)	p-Value (Kruskal Wallis Test)	Post-hoc (Dunn Test)
1 Week (A)	0.40 ± 0.22	0.35 ± 0.23	0.41 ± 0.21	0.73	D vs I-0.77 D vs C-0.82 I vs C-0.64
14 Days (B)	0.28 ± 0.10	0.09 ± 0.08	0.38 ± 0.13	0.0001*	D vs I-0.0001* D vs C-0.74 I vs C-0.0001*
28 Days (C)	0.17 ± 0.12	0.07 ± 0.24	0.46 ± 0.15	0.02*	D vs I-0.28 D vs C-0.01* I vs C-0.02*
p-Value (Friedman Test)	0.0002*	0.0001*	0.06		
p-Value (Convor Test)	A vs B	0.18	0.08	0.21	
	A vs C	0.006*	0.0001*	0.06	
	B vs C	0.52	0.008*	0.93	

Table 4: Papillary bleeding index (PBI).

Discussion

Maintaining good oral hygiene is essential for promoting oral health. Among all tooth surfaces, the interdental areas are difficult to access with regular toothbrush on a daily basis. Therefore, the interdental aids play an important role. Among the various interdental aids present in market today dental floss and interdental brushes play a unique role. The outcomes of the study provide support for the notion that interdental brushes are more effective than dental floss in reducing the amount of interdental plaque and bleeding that occurs among dental students. The wider surface area and different sizes of interdental brushes and their unique personalization for each patient by measuring the interdental spaces for each of them using the colorimetric probe enable a more comprehensive removal of plaque and debris and an atraumatic experience than dental floss, which may miss specific places due to its thin and narrow construction. Interdental brushes are available in a variety of sizes. Additionally, it is possible that the efficiency of dental floss was influenced by the fact that dental students were already familiar with the correct procedures for flossing. Nevertheless, despite this familiarity, interdental brushes still displayed superior outcomes, demonstrating that they had an advantage in terms of maintaining excellent oral hygiene.

The findings of this study are in line with those of earlier research, such as the studies carried out by Christou, *et al.* [9] and Kiger, *et al.* [11], which also revealed that interdental brushes are more successful than dental floss in lowering the amount of plaque that is found between the teeth. Christou, *et al.* [9] discovered that interdental brushes offered a more substantial reduction in plaque levels compared to dental floss. This finding highlights the need to select proper interdental aids for the purpose of preserving oral health. In a similar manner, Kiger, *et al.* [11] revealed that interdental brushes were superior in minimizing gingival bleeding and inflammation, which further supports the findings of the current study.

One of the most prominent aspects of this study is that it is the first randomized controlled trial (RCT) to investigate the effectiveness of dental floss and interdental brushes among dental students. However, this study also has several limitations. Because it reduces the likelihood of biases and other factors that may introduce confusion, the controlled design guarantees the dependability of the findings. With that being said, the generalisability of the study is restricted because it was conducted on a specific demographic of dental students, who might not be representative of the oral hygiene practices and knowledge of the general population. Additionally, the duration of the follow-up period in the trial was quite short, coming in at only 28 days. This may have prevented the researchers from capturing the long-term benefits of employing interdental aids. It is possible that the advantages of continuing to use interdental brushes and floss throughout time may be underestimated because to the short length of this investigation.

In order to expand upon these findings, it is recommended that future research should involve bigger sample sizes and extend the study to a population that is more diverse and general. By doing so, it would be possible to determine whether or not the findings that were seen among dental students can be generalised to the general population. Additionally, lengthier follow-up periods are required in order to evaluate the potential for preserving oral health over time and to analyse the effects that are sustained as a result of the usage of interdental aids. For the purpose of providing a more thorough evaluation of oral health outcomes, it is recommended that future research take into consideration the possibility of including other indices, such as gingival index, probing depth, and clinical attachment levels. These indices have the potential to provide a more comprehensive knowledge of the influence that interdental cleaning has on the reduction of plaque and the health of the periodontal tissues, which can result in more informed recommendations for the practices of daily oral hygiene.

Conclusion

Interdental brushes, selected based on each patient's specific interdental spaces using a colorimetric probe and combined with manual tooth brushing, were more effective in reducing interdental plaque and bleeding compared to dental floss or manual brushing alone.

These findings underscore the importance of integrating interdental aids into daily oral hygiene routines for optimal oral health.

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Volume 23 Issue 9 September 2024

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