Original Research Article

Plaque control efficacy: Interdental brushes versus dental floss

ABSTRACT:

Aims: In this study**,** we compared plaque control efficacy between interdental brushes & dental floss for the prevention of periodontal disease (gingivitis). We also investigated the convenient method for plaque control among these two interdental cleaning methods in routine.
Study design: Randomized clinical trial
Place and Duration of Study: Department of Periodontology at Fatima Jinnah Dental College and Hospital, Karachi, Pakistan from Jan 2019 to July 2020.
Methodology: The sample size of 180 was calculated using OpenEpi software each group (Interdental brush & Dental floss) carried 90 patients respectively at 95% confidence interval and 80% power of the test. Probability sampling technique was used. The Clinical trial was registered at ClinicalTrial.gov (Identifier: NCT05439785). Ethical approval was taken from the Ethical Review Committee of Ziauddin University (1130519MSOM). SPSS version 20 was used to analyze the study data. P-value ≤ 0.05 was considered as significant.
Results: The statistical results showed significant improvement in the plaque score and bleeding index among patients pre and post intervention ($p < 0.001$). Moreover, this study stated that interdental brush was slightly better in reducing interproximal plaque accumulation in patients of gingivitis ($p < 0.001$). The symptom of bleeding from the gingival tissue was also improved by using both interdental cleaning methods. The posterior region appeared to be a difficult site to use both the intervention (interdental brushes or dental floss). Both interdental cleaning methods assisted in the improvement of other symptoms like sensitivity, halitosis, and food impaction in the patients.
Conclusion: The findings of our research revealed that both interdental cleaning methods had a statistically significant effect in removing interdental plaque, with little variation in plaque removal seen between interdental brush and dental floss when compared to baseline. This study endorses better outcome of interdental brush in reducing dental plaque accumulation than dental floss in the gingivitis patients.

Keywords: Gingival bleeding on probing, dental plaque, dental plaque index, oral hygiene, dental floss

1. INTRODUCTION

World Health Organization (WHO) periodontal health is defined as “a condition free from inflammatory periodontal disease that permits an individual to function normally and not undergo any consequences (mental or physical) of underlying inflammatory disease”[1].

Periodontal disease (PD) is an inflammatory condition of the soft and hard supporting tissues of the teeth which initially begin as gingival inflammation (gingivitis) [2]. Gingivitis is defined as "an inflammation of the gums". It initiates when polymicrobial plaque collects on the tooth surface as a result of inappropriate tooth brushing [3]. Gingivitis can be reported with halitosis and painless gingival bleeding, either spontaneously or on brushing teeth [4]. In Contrast to periodontitis, there is no clinical attachment loss and junctional epithelium does not migrate apically and condition only involves soft-tissue area of the gingival epithelium and connective tissue 5.

Multiple factors have been associated with the initiation of gingival inflammation and gingivitis [6]. Dental plaque and calculus, overhanging restorations, tooth anatomic factors, dental prosthesis and malocclusion [7]. Dental plaque is the most common risk factor which is defined as "collection of microorganisms found on a tooth surface as a biofilm, embedded in a matrix of polymers of host and bacterial origin" [5]. Microbial species typically involved in gingivitis are Streptococcus sp., Fusobacterium sp., Actinomyces sp., Veilonella sp., Treponema sp., and a few others [8]. The bacteria in the heavy accumulated plaque on the tooth surface will then penetrate the gingival tissue, particularly the gingival sulcus, and cause the inflammation of marginal gingiva [9].

If gingival inflammation is treated timely, it may hinder the progression of the gingivitis and become periodontitis by inhibiting the destruction of underlying periodontal tissues [10]. This can be possible if a patient maintain good oral hygiene and eradicates the accumulation of interdental plaque [11]. It is essential to brush the teeth regularly in order to prevent initiation and progression of gum diseases. It is required to mechanically remove biofilms from interdental areas by special means to keep periodontal tissues healthy [12]. There are many effective interdental cleaning methods used to remove plaque, amongst which conventional tooth brushing with proper technique, interdental brushes, dental floss, water picks, and oral rinses are worthy [3].

Recently, the emphasis in dentistry has been shifted from intervention to prevention [5]. However, changing dynamics in maintaining oral health and oral hygiene is a complex task [9]. The cleaning of the interproximal areas is regarded as particularly critical because of insufficient space available for cleaning with the use of conventional tooth brushing alone [10]. The association between interproximal oral hygiene (IOH) practices and reduction in plaque mechanism has been under investigations [13]. However, evidence about the most efficient means of interdental tooth cleaning remains ambiguous [11-14]. In this study, we compared plaque control efficacy between interdental brushes & dental floss for the prevention of periodontal disease (gingivitis). We also investigated the convenient method for plaque control among these two interdental cleaning methods in routine.

2. MATERIAL AND METHODS

This was a randomized clinical trial conducted in the Department of Periodontology at Fatima Jinnah Dental College and Hospital, Karachi from January 2019 to July 2020. The sample size of 164 was calculated using OpenEpi software which was rounded off to 180, with each group (Interdental brush & Dental floss) carrying 90 patients respectively at 95% confidence interval and 80% power of the test [13]. Probability sampling technique was used. . The Clinical trial was registered at ClinicalTrial.gov (Identifier: NCT05439785). Figure 1 shows consolidated standards of reporting trials (CONSORT). Ethical approval was taken from the Ethical Review Committee (ERC) of Ziauddin University Karachi, according to the Institutional guidelines (reference code: 1130519MSOM). An informed consent was taken from the patients or attendant of the patient after explaining the purpose of study. All

patients with gingivitis above 18 years to 50 were included in the study. Patients of both genders were included. Those who were excluded were refused to participate, using medications; had systemic problems such as, rheumatic fever, hepatic, renal diseases or diabetes mellitus; patients undergoing orthodontic treatment; pregnant women; habitual of Eating Pan/Gutka/Betel nut/smokers.

A standardized Pro-forma was prepared for data collection. Data was obtained from patients about age, gender, educational status, brushing habits, brush type and dental visit. Using the "coin toss method" the patient was selected either for interdental brush or dental floss group through "random allocation". Heads was denoted as interdental brushing, while tails indicated flossing. The coin toss and allocation procedure was carried out by the researcher's colleagues. This method facilitated to ensure that the researcher was unaware or blinded of the treatment modality being provided to the patient beforehand.

Plaque disclosing tablets were used to disclose plaque and bleeding scores which were recorded using Silness and Loe (1964) and O'Leary et al (1972) plaque score/indexes. "O'Leary et al plaque index (PI) records the presence of supragingival plaque on all four tooth surfaces precisely". "Silness & Loe plaque index ascertains the thickness of plaque along the gingival margin". Bleeding score index was measured before mechanical debridement (scaling root planing). "Ainamo Bay 1975 bleeding index assessed all four surfaces of teeth with regards to whether probing elicits bleeding (+) or not (-)". A video of interdental brush or dental floss was shown to respective group participants so they have a clear understanding of how to use the prescribed interdental cleaning aid. After two weeks the patient was contacted via telephone and oral hygiene instructions were reinforced and the patient was motivated to continue practicing good oral hygiene methods. At the six week follow up, patients were re-evaluated by using plaque disclosing tablets to disclose plaque score and index. The bleeding and plaque scores were rechecked and the differences were recorded.

SPSS version 20 was used to analyze the study data. P-value ≤ 0.05 was considered as significant. The mean/standard deviation for quantitative data and frequency/percentage for qualitative variables were analyzed. To compare the efficacy of plaque control between two interventions (dental floss and interdental brushes) was measured through paired "t" tests. ANOVA test was applied to find association of age and gender with both interventions. Paired "t" test was used to compare the presence of halitosis, sensitivity and food impaction before and after the given interventions.

3. RESULTS AND DISCUSSION

In the study, there were a total of 90 patients recruited in each group. In group 1 (Interdental brush) out of 90, 77 patients turned up on the follow-up visit but remaining 13 patients didn't show-up and were unable to be contacted. Out of 13, 9 patients were male and 4 females. In group 2 (Interdental floss) out of 90, 74 patients turned up however 16 patients didn't come for the follow-up visits. Out of 16 lost patients, 5 were male and 11 females. The mean age of study participants was 32.32 ± 9.5 and 29.04 ± 9.5 in the first and second group respectively. Most of the patients presented with gingival inflammation belonged to the second and third decade of life.

In addition to conventional tooth brushing for the plaque control on the surfaces of teeth, an interdental cleaning method should be implemented to remove microbial plaque from interproximal areas where normal toothbrushes can't reach easily [15]. In this study, we found that interdental cleaning methods (interdental brush and dental floss) in conjunction with conventional brushing appeared to be more effective in reducing plaque from interdental

areas table 1. In both the groups' plaque grade was statistically associated with the middle age ($p<0.001$, 0.009) population as compared to younger and older people. This may indicate that the people who fall in this age group visit dental clinics less and are unable to maintain their good oral hygiene.

Interdental cleaning methods (ICM) are less likely used by the ordinary people in routine, may be due to the technique sensitivity, lack of awareness, cost or fear of trauma to the oral soft tissue [16, 17]. In this study, we compared the efficacy of only two interdental devices (interdental brush and dental floss) so that patients can buy it at a reasonable price and we trained them to use it competently. Some of the studies found interdental brush more effective than dental floss in reducing plaque deposits [18, 19]. Our study endorses the similar outcome that interdental brush was slightly better in reducing plaque from interproximal areas in gingivitis patients.

A study conducted by Rasines G.J concluded that the interdental brush displayed promising results in reducing pocket depth and bleeding index than dental floss in the patients [20]. However, bleeding score was improved with both interdental cleaning aids efficiently in this study. Other studies also suggested that interdental brush combined with toothbrushes is more effective at removing plaque from embrasures than brushing of the teeth alone or tooth brushing combined with dental flossing [21]. In this respect, our study also showed slightly higher efficacy of interdental brush in removing interproximal biofilm matrix in comparison to dental floss with daily use of tooth brushing practices.

According to our research data most of the study participants in both the groups brush their teeth once a day (average 65.5%) especially before meals. The study statistics displayed that most of the study participants in either group don't have a clear understanding of toothbrush type and usually use medium-bristled toothbrushes (average 59.5%) for longer duration which was further aggravating their preexisting condition of gingivitis. Majority of the study participants of both the groups mentioned that they were having dental scaling for the first time due to lack of knowledge (pie-chart 1). Also, stated that they do not use any adjuvant oral hygiene aids other than conventional brushing.

The most distressing symptom results due to gingival inflammation or recession is the presence of tooth sensitivity [3, 21]. This issue makes patients restless and unable to eat, drink cold beverages or brush teeth properly [22]. In this study, there were 48% patients in group 1 and 73% patients in group 2 presented with the complaint of sensitivity due to periodontal disease. The result showed that in both the study groups, the pre and post data analysis of sensitivity demonstrated a noticeable improvement in this symptom among the patients ($p<0.001$, 0.006). There was not a major difference in the improvement of sensitivity issue among the patients of both the groups (Interdental brush and dental floss). Both interventions were found to be efficient in resolving sensitivity issues among the patients of gingivitis.

Halitosis (bad breath) is a chronic symptom which cannot be resolved only with mints, mouthwash or regular brushing [23]. In contrast to "morning breath" or a strong smell that lingers after a food, halitosis stays for a long period of time and may indicate a sign of something more alarming [3]. In the study groups, the pre and post data analysis of halitosis showed a marked improvement in the symptom among both the groups of patients ($p<0.001$, 0.019) table 2. However, in group 2 (Dental floss) 17.2% patients reported no improvement in halitosis but this symptom was improved among all the patients after using interdental brush. We can conclude that interdental brush was more effective in cleaning plaque from the interproximal areas which ultimately resolved the issue of halitosis among the patients of gingivitis.

Food impaction is the manifestation of deficient proximal contact between teeth, and interdental floss was recommended to remove the adherent food particles from the spaces [24]. Both the interventions had facilitated the reduction of the impaction of food particles in the interproximal spaces with statistically significant results ($p<0.001$). The concern of food impaction between teeth was well solved by using interdental brush in all the patients. However, 13.5% patients in the study group 2 (dental floss) still presented with the same problem on the follow up visit even using the dental floss the entire month. These adjuvants, when added to traditional oral hygiene, have been demonstrated to increase biofilm control during periodontal maintenance therapy (PMT), resulting in better periodontal status maintenance [25, 26].

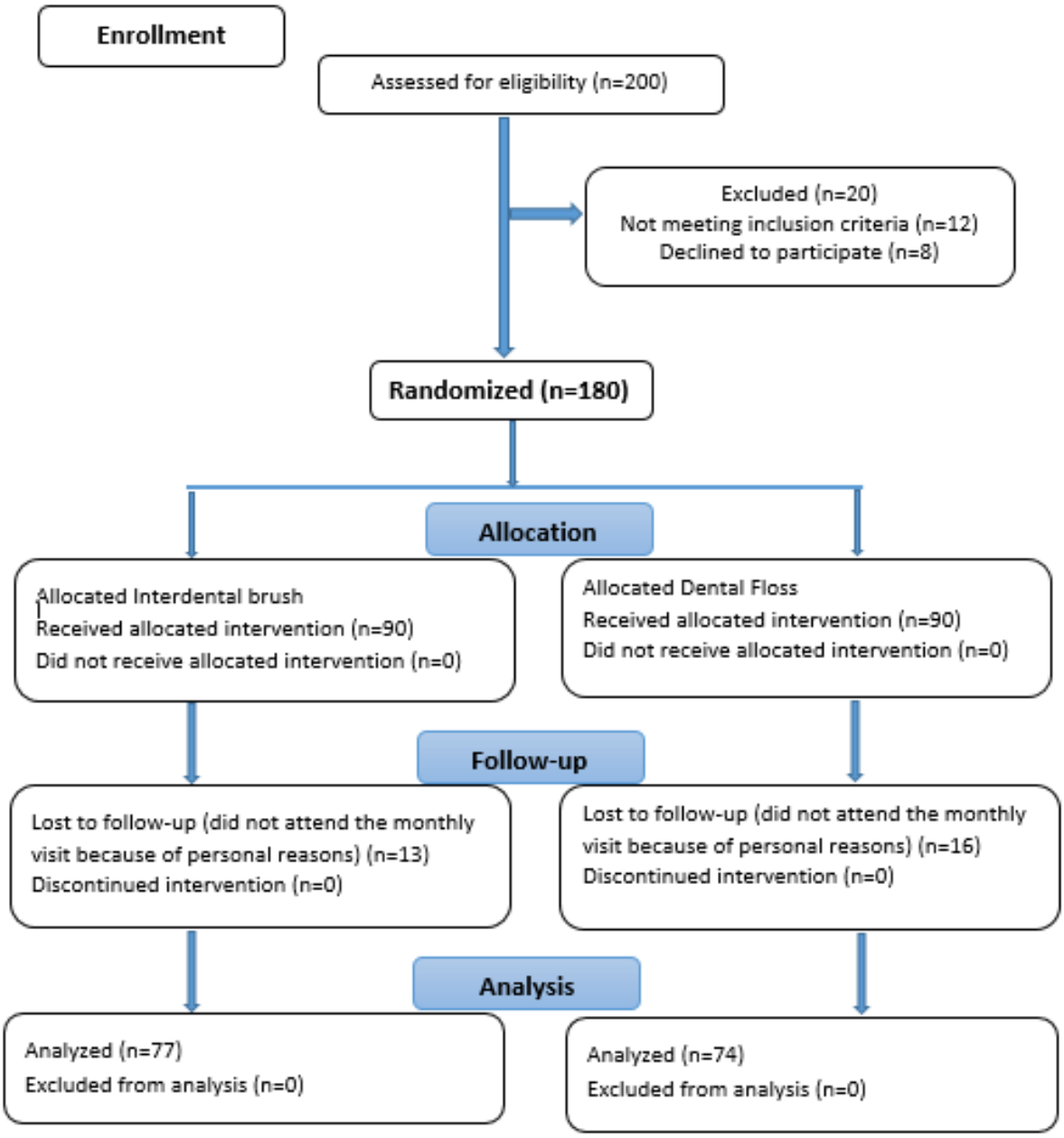


FIGURE 1: Shows study consolidated standards of reporting trials (CONSORT)

TABLE 1: Analysis of means and standard deviations of the pre and post plaque and bleeding score of the interdental cleaning method (Group 1 Interdental Brush/ Group 2 Dental Floss)

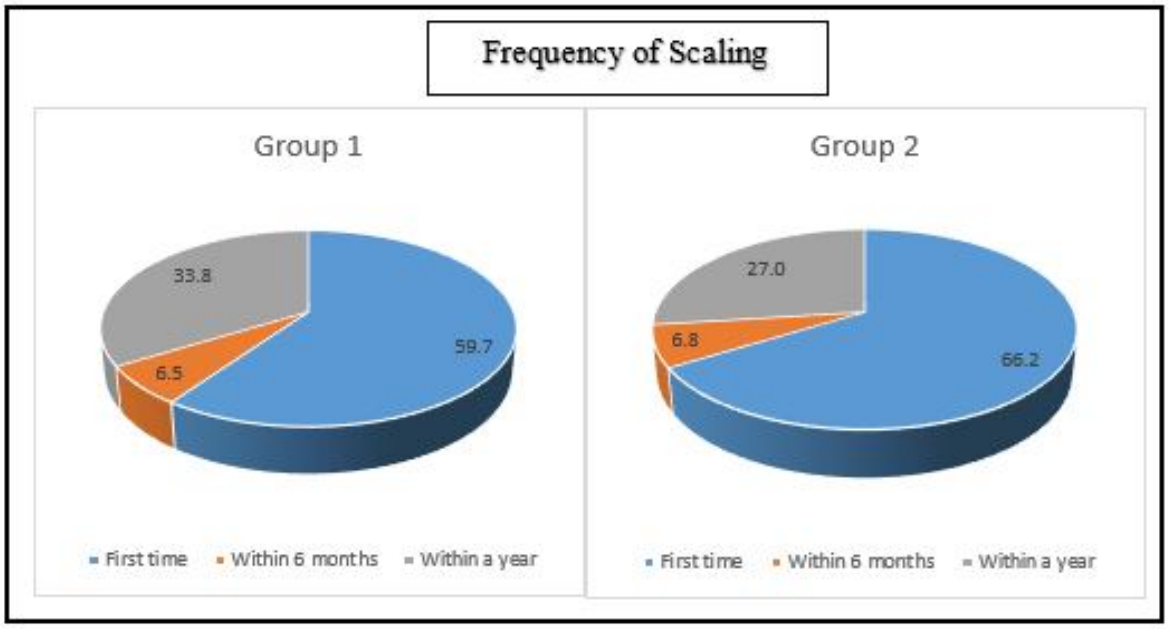
GROUPS	S:No	VARIABLES	Mean	Std. Deviation	Minimum	Maximum	p-value
Group 1 Interdental Brush	**PLAQUE SCORE**						
	1	Pre-intervention	55.7383	14.64	24.77	91	**<0.001***
		Post intervention	34.5966	14.03	16.36	73	
	BLEEDING INDEX						
	2	Pre-intervention	46.4131	14.26	20.34	84.25	**<0.001***
		Post-intervention	30.13	10.5	14.32	69.65	
Group 2 Dental Floss	**PLAQUE SCORE**						
	1	Pre-intervention	66.22	14.6	35	90.21	**<0.001***
		Post-intervention	35.03	14.0	11.69	61	
	BLEEDING INDEX						
	2	Pre-intervention	41.34	14.2	19.64	69.64	**<0.001***
		Post-intervention	23.37	10.5	8	54.50	

*p-value <0.05 is considered to be statistically significant

TABLE 2: Evaluation of oral symptoms such as sensitivity, halitosis and food impaction pre and post intervention in group 1 (Interdental brush) through paired t-test.

GROUPS	S:No	VARIABLES	YES	NO	IMPROVED	p-value
Group 1 Interdental Brush	**SENSITIVITY**					
	1	**Pre-intervention**	37 (48.1%)	40 (51.9%)	-	**<0.001***
		Post-intervention	16 (20.8%)	40 (51.9%)	21 (27.3%)	
	HALITOSIS					
	2	**Pre-intervention**	26 (33.8%)	51 (66.2%)	-	**<0.001***
		Post-intervention	0 (0%)	51 (66.2%)	26 (33.8%)	
	FOOD IMPACTION					
	3	**Pre-intervention**	26 (33.8%)	51 (66.2%)	-	**<0.001***
		Post-intervention	0 (0%)	51 (66.2%)	26 (33.8%)	
Group 2 Dental Floss	**SENSITIVITY**					
	1	**Pre-intervention**	54 (73%)	20 (27%)	-	**<0.006***
		Post-intervention	15 (20.3%)	20 (27%)	39 (52.7%)	
	HALITOSIS					
	2	**Pre-intervention**	29 (39.2%)	45 (60.8%)	-	**<0.019***
		Post-intervention	5 (6.7%)	45 (60.8%)	24 (32.4%)	
	FOOD IMPACTION					
	3	**Pre-intervention**	54 (73%)	20 (27%)	-	**<0.001***
		Post-intervention	10 (13.5%)	20 (27%)	44 (59.5%)	

*p-value <0.05 is considered to be statistically significant



PIE-CHART 1: Frequency of Scaling among study participants

4. CONCLUSION

In the study, we have received good patients' compliance and effective use of interdental cleaning methods (interdental brush and dental floss). The findings of our study revealed that both interdental cleaning methods had a significant effect in removing interdental plaque, with little variation in plaque removal seen between interdental brush and dental floss when compared to baseline. This study endorses better outcome of interdental brush in reducing dental plaque inter-proximally than dental floss in the gingivitis patients. Interdental brush was observed to be more comfortable and effective to use in routine but technique sensitive in comparison to dental floss.

CONSENT

"All authors declare that 'written informed consent was obtained from the patient. A copy of the written consent is available for review by the Editorial office/Chief Editor/Editorial Board members of this journal."

ETHICAL APPROVAL

Ethical approval was taken from the Ethical Review Committee (ERC) of Ziauddin University Karachi, according to the institutional guidelines (reference code: 1130519MSOM)

"All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki."

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