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Original Research Article

Comparative evaluation of effectiveness of calibrated inter-dental brushes in maintaining oral hygiene and periodontal health: a randomized controlled clinical trial

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ABSTRACT

Background: Effective oral hygiene is a crucial factor in maintaining good oral health, which is associated with overall health and health-related quality of life. The control of biofilm is the common pillar of the prevention and control of periodontal disease. The interdental brush (IDB) currently represents the primary and most effective method available for interproximal cleaning compared with brushing alone or the combined use of tooth brushing and dental floss.
Methods: A total of 40 participants, with 10 each in control and test group, participated in the study. Clinical examination of gingival index, full mouth bleeding scores and plaque index were recorded supra gingival scaling was performed. Test group- interdental brushes were given and oral hygiene instructions were given through Touch-to Teach method (TOP). At 4 week and 6 week follow up oral hygiene instructions were repeated to respective groups. After 3 months, clinical examination was done and exit survey on patient-reported outcome measures was administered.
Results: Intergroup comparison of gingival index, plaque index and pocket probing depth showed statistically significant difference between test and control group.
Conclusions: Within the limitations of the study, we concluded that the appropriate use of interdental brushes along with effective oral hygiene maintenance using TOP permitted proper cleaning of the area with a significant reduction in plaque and gingivitis.

Keywords: Interdental cleansing aids, Interdental brushes, Oral hygiene, TOP method, Plaque index, Gingival index

INTRODUCTION

Periodontitis is clearly correlated with systemic diseases. The removal of interproximal biofilm is considered to be important for the maintenance of gingival health, prevention of periodontal disease and the reduction of caries. As an adjunct to brushing, the interdental brush (IDB) currently represents the primary methods available for interproximal cleaning aids. The presence of periodontal pathogens in interdental spaces in healthy individuals is a strong indicator of the need to introduce daily interdental prophylaxis.[1]

The removal of interproximal biofilm is considered to be important for the maintenance of gingival health, prevention of periodontal disease and the reduction of caries. As an adjunct to brushing, the interdental brush (IDB) currently represents the primary methods available

for interproximal cleaning. The majority of the studies presented a positive significant difference in the plaque index when using the IDB compared with floss. IDB's are more effective in removing plaque as compared with brushing alone or the combination use of tooth brushing and dental floss.[2]

Dental floss is recommended for individuals with closed interdental spaces, and interproximal brushes are recommended for periodontal patients or in those with open embrasures.[3] In the selection of interdental cleaning tools, the clinical characteristics of embrasures, the condition of the gums and the personal needs of the patient should be taken into account. IDB have variations in size and diameter and have thus become an alternative to dental floss. Studies have shown that IDB used in combination with toothbrushes are more efficient in plaque removal for embrasures than tooth brushing alone or the use of tooth brushing in combination with dental flossing.[4]

Considering the pitfalls of conventional methods of oral health educational aids and also due to the increasing prevalence of dental diseases like dental caries and periodontal diseases, a patient centric, personalized approach called 'Individually Trained Oral Prophylaxis (TOP) which uses a Touch-to-Teach' concept was introduced by Dr. Jifi Sedel mayer. It is a systematic way to learn optimal oral health management through hands-on training (Touch-to-Teach) with the use of selected tools and techniques. TOP is an effective and non-traumatic way of learning good oral care. The principle is based on practicing the knowledge and skills on a daily basis for dental professionals themselves and eventually for patients.[5]

Hence, this study aimed to evaluate the efficacy of oral hygiene instruction methods and outcomes of the calibrated inter-dental brushes on developing gingival and periodontal diseases in an individual.

METHODS

This was a randomized controlled trial conducted among the patients reporting to the out-patient department (OPD) of Department of Periodontics who were visiting with the chief complaint of bleeding gums and food lodgment in interdental spaces at KAHER's KLE VK Institute of dental sciences, Belagavi subjects were selected according to inclusion criteria. Sample size was estimated 40 according to the sample size estimation formula. All the forty samples of the study group will be allocated randomly into four equal groups of ten each by simple random sampling using computer allocation method to ensure standardization.

Group A (color code Pink)

Consisting of 10 cases receiving scaling and root planing procedure performed and routine brushing technique with modified Bass technique. Pink Interdental brush to clean the class I embrasure (Tight Gap).

Group B (color code Red)

Consisting of 10 cases receiving scaling and root planing procedure performed and routine brushing technique with modified Bass technique. Red Interdental brush to clean the class II embrasure (Narrow Gap).

Group C (color code Blue)

Consisting of 10 cases receiving scaling and root planing procedure performed and routine brushing technique with modified Bass technique. Blue Interdental brush to clean the class III embrasure (Wide Gap).

Group D (Control Group)

Consisting of 10 cases receiving scaling and root planing treatment and regular brushing with modified Bass technique.

After comfortably seating the patient on the dental chair, the procedure was completely explained to the patients by the Principal Investigator. A case history was recorded so as to have a systematic and methodological recording of all the observations and information. After recording the preliminary information, clinical examination included gingival index, sulcus bleeding index and plaque index were carried out on a dental chair. Color-coded interdental brushes (Stim company Proxa) are having pink for tight gap (color code No 0) class I embrasure, for narrow gap red (color code No 2) class II embrasure and blue for wide gap (color code No3) class III embrasure color coded interdental brushes for 3 different groups were distributed to the subjects depending upon the size of the embrasure and were instructed to use once daily after having the meals.

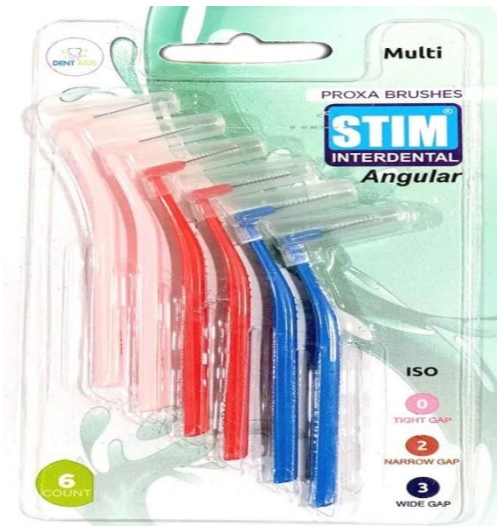

Figure 1: STIM interdental brushes.

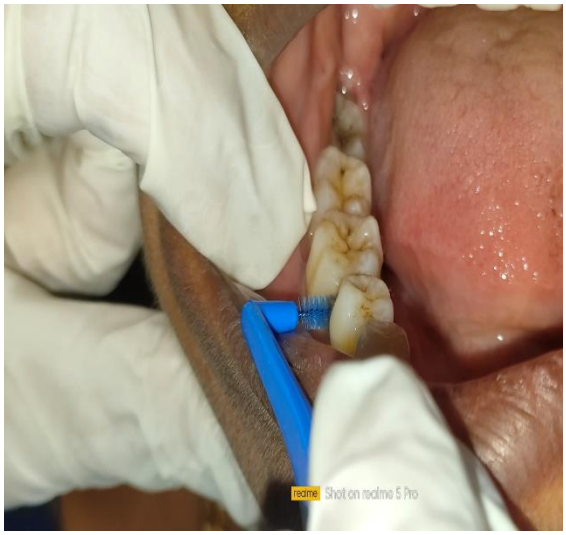

Figure 2: Interdental cleaning using the brush.

All the clinical examination was done by a single examiner who was blinded to allocation of participants groups. For the control group, Oral hygiene instructions was given without distribution of any interdental brushes. For the test groups, oral hygiene instructions for the use of interdental brush were given using Touch-to-Teach method which involves hands-on teaching of correct use of oral hygiene aids by a trained instructor. Participants were made to sit comfortably on dental chair and mirror was given to them to watch while the instructor performs the correct use of interdental brush in their mouth.

The interdental brush is gently inserted above the tip of the interdental Papilla at an angulation that does not traumatize the papilla. The interdental brush is inserted in parallel manner without applying much pressure. The brush is gently passed through and taken out carefully. Post-operative instructions were given to all participants. At 4-week and 6-week follow up all participants gingival index, plaque index and sulcus bleeding index were recorded and post-operative instructions were repeated to both control and test group. The study was conducted over a course of 4 months, from 10/10/2022 to 27/1/2023. On completion, the obtained data was subjected to statistical analysis using SPSS software version 21. Descriptive statistics was done, followed by repeated measure ANOVA and one way ANOVA for inter and intra group comparisons.

Ethics approval and consent to participate: The study protocol was reviewed and approved by the institutional ethics committee of KAHER's KLE University. All participants signed a consent form before the start of the study.

RESULTS

Table 1 and shows intergroup comparison of mean plaque score at baseline, with plaque score at 4th week and 6th week from the start of the intervention.

Table 1: Comparison of mean plaque score at baseline, with plaque score at 4th week and 6th week from the start of the intervention.

Group (*n*=10)	Mean± SD			Statistics	
	Baseline	4 weeks	6 weeks	F-value	*p*-value
Group 1	1.87± 0.58	1.57±0.49	1.33±0.53	$22.2^{\$}$	<.001*
Group 2	1.74±0.54	1.50±0.54	1.27±0.53	$51.7^{\$}$	<.000*
Group 3	1.81±0.60	1.60±0.64	1.47±0.60	$77.3^{\$}$	<.001*
Group 4	1.88±0.74	1.90±0.74	1.95±0.67	$1.2^{\$}$	0.348
F-value	0.108^{+}	0.840^{+}	2.74^{+}		
***p*-value**	0.955	0.481	0.057		

*Statistically significant, '$' statistical test used repeated measure ANOVA, '+' statistical test used one-way ANOVA.

Table 2: Comparison of mean gingival index score at baseline, with gingival score at 4th week and 6th week from the start of the intervention.

Group (*n*=10)	Mean± SD			Statistics	
	Baseline	4 weeks	6 weeks	F-value	*p*-value
Group 1	2.12± 0.55	1.94±0.55	1.73±0.52	$51.48^{\$}$	<.000*
Group 2	2.00±0.56	1.83±0.60	1.68±0.58	$42.95^{\$}$	<.000*
Group 3	2.06±0.52	1.89±0.52	1.74±0.47	$23.46^{\$}$	<.000*
Group 4	2.04±0.66	1.95±0.63	1.97±0.59	$11.27^{\$}$	0.005*
F-value	0.076^{+}	$0..091^{+}$	0.569^{+}		
***p*-value**	0.97	0.97	0.64		

*Statistically significant, '$' statistical test used repeated measure ANOVA, '+' statistical test used one-way ANOVA.

Table 3: Comparison of mean pocket probing depth score at baseline, with pocket probing depth score at 4th week and 6th week from the start of the intervention.

Group (*n*=10)	Mean± SD			Statistics	
	Baseline	**4 weeks**	**6 weeks**	**F-value**	***p*-value**
Group 1	1.20±2.57	1.00±2.16	0.70±1.49	1.00$	0.41
Group 2	2.50±3.31	1.90±2.51	1.50±2.01	2.66$	0.13
Group 3	1.50±3.17	1.10±2.33	1.00±2.11	1.00$	0.41
Group 4	0.50±1.58	0.50±1.58	0.40±1.26	1.00$	0.34
F-value	0.92+	0.71+	0.71+		
***p*-value**	0.44	0.55	0.55		

*Statistically significant, '$' statistical test used repeated measure ANOVA, '+' statistical test used one-way ANOVA.

It suggests that the plaque scores decreased from baseline to the 4th and 6th week post intervention respectively in the test groups compared to the control group. The difference in the plaque scores was statistically significant from baseline to 4- and 6-weeks post intervention in the test and the control groups.

Table 2 shows comparison of mean gingival index score at baseline, with gingival score at 4th week and 6th week from the start of the intervention. It suggests that the gingival index scores decreased from baseline to the 4th and 6th week post intervention respectively in the test groups compared to the control group. The difference in the gingival scores was statistically significant from baseline to 4- and 6-weeks post intervention in the test and the control groups.

Table 3 shows comparison of mean pocket probing depth score at baseline, with pocket probing depth score at 4th week and 6th week from the start of the intervention. It showed a statistically significant difference in the pocket probing depth from baseline to 4- and 6-weeks post intervention in the test and the control groups.

DISCUSSION

Periodontitis are multifactorial oral disease mainly due to bacteria and more particularly to the dysbiosis of the oral microbiota. The symbiotic host-microbe relationship gradually changing to a pathogenic one. The periodontal health deteriorates until a state of clinical disease occurs. Simultaneously, a succession of microbial complexes develops. Effective oral hygiene is crucial for maintaining good oral health, which is associated with global health.

In the present study, TOP method was used where the Touch-to-teach concept was advocated to patients and they showed high compliance to this method of oral hygiene maintenance. The results showed a significant decrease in the plaque scores where this TOP method has been a contributing factor.[6]

New preventive products have been developed and recommended by professional to protect sites at risk. Dental floss has been used for many years in conjunction with brushing for removing dental plaque in between teeth. Also, interdental brushes have been developed which many people find easier to use than floss, providing there is sufficient space between the teeth. An interdental brush, which is sized correctly for each interdental space, is easy to handle and will be atraumatic to the papillae.[7]

All three test groups have shown reduction in plaque indices when compared to control group with statistically significant reduction in plaque scores at 4th and 6th week. This was in accordance with the study conducted by Gulbahar et al, 2020.[8]

Reduction in the gingival scores was observed when compared to the control group at 4th and 6th week from baseline. This could be due to the reduction in plaque formation as the patients strictly adhered to the oral hygiene regimen using the TOP method. These findings were similar to the ones seen in a study conducted by Denis Bourgeois et al in 2019.[5]

We observed a statistically significant reduction in pocket probing depths as well when compared to the control group at the 4th and 6th week post intervention. This was noted owing to the optimal oral hygiene maintenance and reduction in the plaque formation and reduced gingival bleeding. Similar findings were observed by Prabhuji et al in 2021.[6]

Although various color coded calibrated interdental brushes are available in the market, we restricted their use as there very limited literature supporting their use.

In our study the participants in the study group were provided with the correct sized interdental brushes, so the area would be sufficiently cleaned with any harm to the gingival tissues. The substantial decrease in the plaque score, the gingival index and the pocket probing depth suggested that proper interproximal cleansing can reduce the occurrence or recurrence of gingivitis and its further progress to periodontitis.

Microbial assessment for the responsible organisms was not performed in this study and this could be one of the few limitations.

CONCLUSION

Within the limitations of the study, we concluded that the appropriate use of interdental brushes along with effective oral hygiene maintenance using TOP permitted proper cleaning of the area with a significant reduction in plaque and gingivitis. Acceptance of interdental brush was regarded to be good. Interdental cleaning should become a routine practice in the maintenance of oral hygiene for the reduction of interproximal plaque, the control of gingivitis and improvement of patient motivation. It is imperative that the results from this study are made available to the scientific community as it can contribute to evidence-based research in dentistry. The advantages of interdental cleaning in the maintenance of oral hygiene should be made accessible to the community as a whole by effective collaboration of the health professionals, dentists, social providers and patients so as to widen their knowledge in the field and improve their quality of life. In conclusion, the use of interdental cleaning aids should be incorporated into the daily practices of oral health care.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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