

Comparative Evaluation of the Efficacy of Flossing With and Without Holder as an Adjunct to Toothbrushing with Sulcular Method – A Randomized Clinical Trial¹Dr. Shivali Vashisht, Post Graduate, Himachal Dental College, Sundernagar, Mandi, Himachal Pradesh²Dr. Vikas Jindal, HOD, Himachal Dental College, Sundernagar, Mandi, Himachal Pradesh³Dr. Ranjan Malhotra, Professor, Himachal Dental College, Sundernagar, Mandi, Himachal Pradesh⁴Dr. Amit Goel, Professor, Himachal Dental College, Sundernagar, Mandi, Himachal Pradesh⁵Dr. Malvika Thakur, Senior Resident, Himachal Dental College, Sundernagar, Mandi, Himachal Pradesh⁶Dr. Ashima Verma, Post Graduate, Himachal Dental College, Sundernagar, Mandi, Himachal Pradesh**Corresponding Author:** Dr. Shivali Vashisht, Post Graduate, Himachal Dental College, Sundernagar, Mandi, Himachal Pradesh**Citation of this Article:** Dr. Shivali Vashisht, Dr. Vikas Jindal, Dr. Ranjan Malhotra, Dr. Amit Goel, Dr. Malvika Thakur, Dr. Ashima Verma, “Comparative Evaluation of the Efficacy of Flossing With and Without Holder as an Adjunct to Toothbrushing with Sulcular Method – A Randomized Clinical Trial”, IJDSIR- June - 2020, Vol. – 3, Issue -3, P. No. 485 - 491.**Copyright:** © 2020, Dr. Shivali Vashisht, et al. This is an open access journal and article distributed under the terms of the creative commons attribution noncommercial License. Which allows others to remix, tweak, and build upon the work non commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.**Type of Publication:** Original Research Article**Conflicts of Interest:** Nil**Abstract**

Oral health has a major effect on the general aspect of life and well-being. With the increasing rate of oral diseases, effective oral hygiene is a key factor for maintaining good oral health. Among overall oral health procedures, the control of formation of interproximal biofilm formation requires use of an interdental oral hygiene aid, one such aid routinely used is dental floss as an adjunct to toothbrushing in type I embrassures. This four week study was to evaluate the efficacy of flossing with and without holder as an adjunct to tooth-brushing with sulcular method. The study population included 80 subjects. In Group I manual toothbrush and dental floss without holder and in Group II dental floss with holder was used. Two

weeks before the beginning of the study, participants got an intraoral examination and a full mouth oral prophylaxis. The manual brush used by subjects in Groups I and II was a standard soft-bristle brush. The three variables were the interdental gingival index, interdental plaque index and oral hygiene index. Mean differences between test and control sites were compared using student ‘t’-test. The mean difference was compared between different time intervals using ANOVA. The results were considered statistically significant at $P < 0.05$. Dental floss with holder shown significant results when compared to floss without handle in interdental plaque index, interdental gingival index and oral hygiene index. After four week study it was concluded that the floss with

handle has better results due to ease of manipulation especially in the posterior teeth and dexterity along with less trauma to the interdental papilla.

Keywords: sulcular method, dental floss, oral hygiene, toothbrush, periodontitis, gingivitis

Introduction

To maintain good oral health is the key not only for teeth and gums but also for overall health, as infections and bacteria which are present in the mouth can spread to other parts of the body, leading to heart problems, uncontrolled diabetes and even some forms of cancer. Poor oral health intraorally may affect outer shell in terms of stained or missing teeth (Exley 2009) and can lead to bad breath (Morita 2001) thus negatively influencing self-confidence, coherence and communication (Exley 2009; McGrath 2002).¹ The public's use of restraint procedures to maintain favourable oral health is a main concern of the dental profession nowadays.² Individuals with increased levels of dental biofilm are more likely to incident tooth decay, periodontal disease which may further lead to uneasiness when eating (Broadbent 2011).¹ Therefore, the regulation of dental biofilm is a main goal of dental professionals and is of crucial concern to maintain and improve oral health.

Several therapeutic approaches to control dental biofilm exist, which uses the mechanical and oral rinsing with chemotherapeutic as an adjunct and thus maintains good gingival health. In spite of the varied range of approaches available, mechanical removal of plaque remains the generally accepted method for maintaining good oral hygiene. There are various types of toothbrushes designed to achieve maximum biofilm control. But tooth brushing alone, removes biofilm at the buccal, lingual, and occlusal surfaces³ however, does not reach the interproximal areas of the dentition, especially the posterior, which are the least accessible⁴⁻⁵ so that part of the dentition is left

unclean. For this reason, soft or hard deposits accumulate in the space between teeth in almost all patients.⁵ It has been also convincingly demonstrated that periodontal disease is most frequent and severe in the interproximal areas and recognized to progress faster interdentally. The control of interproximal biofilm formation requires use of an interdental oral hygiene aids, namely dental floss, interdental brushes, unitufted proxabrushes and toothpicks. These interdental cleaning aids make various claims for their beneficial effects in terms of reduction in biofilm and gingival inflammation.³ The choice of the type of technique must, be made in relation to the characteristics of the interdental spaces whether they are open or closed (Sicilia et al 2003), as well as the morphology of the proximal tooth surface. Customarily for self-care recommendations flossing (ADA 2014) is most universally accepted method. The interdental floss has effect both on the both central part of the interdental space and on the embrasures thus removes biofilm as 2-2.5 mm below the gingival margin (waerhaug1976).⁶ There are two common methods for flossing, the "manual flossing by use of fingers and dental floss holder which is a device that eliminates the need for placing fingers in the mouth."⁷ Proper use of interdental aid also depends on preferences and the expected likelihood⁸ and knowledge about the evidence specific to each device which are used and the expected outcomes from using the devices.⁹⁻¹¹ An ideal interdental cleaning device should be user friendly, removes biofilm effectively and have no deleterious soft tissue or hard tissue effects.¹² Further, floss holders are significantly more effective in helping patients establish a long-term flossing habit than hand-flossers.¹³ The dental professional should therefore, navigate the patient to the most favourable devices modified to their specific needs.⁶ So purpose of this study was undertaken to evaluate the respective effectiveness of the tooth brushing with

flossing by two methods using dental floss with holder and dental floss without holder with spool method as an adjunct to tooth brushing.

Subjects and Methods

In this cross-sectional study, total 80 subjects between 19 to 23 years of age were taken without regard to gender or ethnic origin. After selection, the subjects were informed about the purpose and duration of the study. The protocol was approved by the Himachal Dental College, Sundernagar ethical committee and signed an informed consent.

Inclusion criteria included medical history indicative of general good physical health, absence of supra and subgingival calculus, subjects having type I embrasures (interdental papilla completely filling the interdental gingival embrasures), current manual brushing users and only subjects that reported at least one-time daily brushing. Exclusion criteria included lack of dexterity required for tooth brushing or flossing, evidence of neglected proper oral hygiene, major hard and soft tissue lesions or trauma and prophylactic or therapeutic antibiotic use within two months prior to the study.

The participants for this study were randomized into two groups. In Group I floss without holder and in Group II floss with holder. The manual brush used by subjects in Groups I and II was a standard soft-bristle brush. All participants were well motivated regarding oral hygiene and were familiarized with the use of dental floss and the sulcular method for the manual tooth brushing. The instructions were given verbally and in writing as well. For each participant the floss which was to be used was randomly selected and presented. A new toothbrush was given to each participant before starting of the study. All participants were asked to brush for atleast two minutes twice daily with the provided brush, and to abstain from

using any additional oral hygiene aid which was not assigned, including mouth rinses.

Subjects were examined by two experienced examiners. Each examiner examined the same subjects during the course of the study. Subjects were asked to abstain from any oral hygiene measures atleast 12 hours prior to each study visit. After baseline data were recorded at the first visit, subjects received the equipments required for their allocated oral hygiene routine. The floss and toothbrushing techniques were demonstrated again to each subject.

GROUP I -The floss without holder group was instructed to floss once daily in the morning. The instructions given were as follows: The floss should be passed carefully from the facial to the lingual surface. The biofilm removal should be performed by pressing the floss firmly against the tooth surfaces, mesial and distal respectively and scrubbed up and down, enfold the floss around middle fingers by using the index fingers and thumb to guide the floss.

GROUP II- The participants in the floss with holder group were instructed to floss once daily in the morning. The instructions given were as follows: Floss with holder was pressed around the side and moved up and down the tooth.



Figure 1: (a) Floss without handle (b) Floss with handle
Two weeks before the beginning of the study, participants got an intraoral examination and a full mouth oral prophylaxis. The participants were then instructed to carry on with their usual oral hygiene routine. Two weeks later,

participants underwent baseline registration of gingival inflammation and plaque accumulation and oral hygiene maintenance.

The amount of plaque that had accumulated in the cervical part of the teeth was registered by Modified Proximal Plaque Index (MMPI),¹³ gingival inflammation in the interdental embrasures was registered by the interdental gingival index and oral hygiene index measured by adding debris index and calculus index at the baseline, 7th day, 14th day and 28th day respectively.

Table 1: Intergroup comparison of Gingival Index

Time Interval	floss with handle		floss without handle		t	df	Sig. (2-tailed)
	Mean	SD	Mean	SD			
Base	0.180	0.056	0.193	0.078	-0.539	28	0.59
7th day	0.163	0.055	0.190	0.039	-1.536	28	0.14
14th day	0.157	0.059	0.177	0.068	-0.86	28	0.40
28th day	0.141	0.053	0.180	0.062	-1.832	28	0.08

P < 0.001- Highly significant, p < 0.05- Significant, p > 0.05 Not significant (NS)

The descriptive summary of gingival Index obtained with two different type of floss use (with and without handle) is presented in table 1.

The mean GI at different time interval for without floss handle group varied between 0.177 to 0.193. However, it did not show any declining pattern. The mean was maximum at baseline (0.193 ± 0.078) and minimum at 14th day (mean 0.177 ± 0.068). Intragroup paired comparison of Gingival Index obtained at different time interval for the floss without handle group showed a different pattern from with handle group; the mean GI declined from baseline to 7th day (mean difference 0.003 ± 0.077), then further declined from 7th to 14th day (mean difference = 0.013 ± 0.086) and finally increased from 14th to 28th day (mean difference = 0.003 ± 0.064) and none of these differences were statistically significant.

Results

80 participants with a mean age of 23.2±1.22 years participated in this study. The minimum age was 19 and the maximum was 25.

The mean GI at different time interval for with floss handle group varied between 0.141 to 0.180 and showed a declining tend from baseline to 28th day; maximum at baseline and minimum at 28th day as described in table 1.

Intragroup paired comparison of Gingival Index obtained at different time interval for the floss with handle group showed a declining pattern of mean GI from baseline to 28th day. The differences between the mean values of GI obtained for different paired time intervals, viz, baseline and 7th day, 7th day and 14th day and 14th and 28th were 0.017, -0.007 and 0.015 respectively and none of these differences appeared to be statistically significant.

The descriptive summary of Plaque Index (PI) obtained with two different type of flossing used (with and without handle) is presented in table 2.

The mean PI at different time interval for with floss handle group varied between 0.200 to 0.449 and between 0.507 to 0.357 for floss without handle group. Indicating a higher mean value of PI for floss without handle group. For both the groups, there is a gradual decline in PI from baseline to 28th day. Comparison of mean values of PI obtained at different time interval by independent sample t test did not yield any statistically significant

difference at any time interval level. Intergroup comparison of Plaque Index at different time interval

	floss with handle		floss without handle		t	df	Sig. (2-tailed)
	Mean	SD	Mean	SD			
Base	0.449	0.254	0.507	0.375	-0.496	28	0.624
7th day	0.443	0.219	0.449	0.236	-0.064	28	0.949
14th day	0.380	0.240	0.397	0.192	-0.21	28	0.835
28th day	0.200	0.131	0.357	0.159	-2.945	28	0.006

P < 0.001- Highly significant, p < 0.05- Significant, p > 0.05 Not significant (NS)

Intragroup paired comparison of Plaque Index obtained at different time interval for both the groups. A statistically significant difference was obtained in the flossing with handle group when the mean PI at 14th day (mean = 0.38 ± 0.240) was compared with the mean PI at 28th day (0.20 ± 0.13). The mean difference was 0.18 ± 0.23, which appeared to be statistically significant (t(14)) = 3.066, p = 0.008.

The descriptive summary of Oral Hygiene Index (OHI) obtained with two different floss type (table 3).

Like GI and PI, the OHI also showed a declining trend from baseline to 28th day, maximum values of mean OHI were obtained at baseline and minimum values were obtained at 28th day for both types of floss.

Mean OHI at baseline for floss with handle group (1.047±0.30) although higher than the mean obtained floss

without handle group (mean 0.997 ± 0.18) but this difference did not appear to be statistically significant (t (28) = 0.550, p = 0.587. Mean OHI at 7th day for floss with handle group (0.867±0.31) was also higher as compared to the mean obtained for floss without handle group (mean 0.763 ± 0.27) and the difference was not statistically significant (t (28) = 0.978, p = 0.337. Mean OHI at 14th day for floss with handle group (0.597±0.31) however showed a lower value as compared to the mean obtained for floss without handle group (mean 0.613 ± 0.21) and this difference was also not statistically significant (t (28) = -0.203, p = 0.840. Mean OHI at 28th day for floss with handle group (0.290±0.18) showed a lower value as compared to the mean obtained for floss without handle group (mean 0.477 ± 0.16) and this difference was statistically significant (t (28) = -2.95, p = 0.006.

Intergroup comparison of Oral Hygiene Index at different time interval

Time interval	floss with handle		floss without handle		t	df	Sig. (2-tailed)
	Mean	SD	Mean	SD			
Base	1.047	0.30	0.997	0.18	0.550	28	0.587
7th day	0.867	0.31	0.763	0.27	0.978	28	0.337
14th day	0.597	0.23	0.613	0.21	-0.203	28	0.840
28th day	0.290	0.18	0.477	0.16	-2.951	28	0.006

P < 0.001- Highly significant, p < 0.05- Significant, p > 0.05 Not significant (NS)

Paired comparison of Oral Health Index obtained at different time interval for both the groups revealed that differences between the means of all paired group of time

interval for both the groups were highly statistically significant (table 3).

Discussion

Evidently dental biofilm is the major etiological factor for the periodontal disease to occur. With the development of

dental plaque, there is colonization of pathogenic microorganisms that releases various endotoxins, which causes inflammation of gingiva.⁸Hence, daily removal of interproximal biofilm is an important factor for the maintenance of dental and periodontal health. By various researches conducted earlier it has been proved that flossing in interdental areas when used as an adjunct to tooth brushing proved to be an efficient device for the reduction of biofilm from tooth surfaces. **Barendregt et al**; in 2002 stated that flossing is an effective tool in preventing the development of gingival inflammation and reducing the level of plaque. The ADA reports that up to 80% of plaque may be removed by dental flossing. Several dental professionals have suggested the use of dental floss along with regular tooth brushing to prevent periodontal disease.

This current study was designed to discover whether the tooth brushing alongwith flossing with holder and flossing without holder would influence interdental plaque amount, debris and calculus and interdental gingival inflammation. It is probable that by using dental floss with holder, the existing soft particles in the interdental area are pushed out by the floss with holder and brushing immediately afterward can eliminate those particles much easily. However, when we use dental floss without holder, much of the particles that are being removed by dental floss would stay in place due to lack of handling or how to use floss without handle in interproximal areas mainly in the posterior teeth. Similar study was done by **Pucher et al** in 1990, in which they evaluated the clinical effectiveness of floss Plus easy flosser versus hand held floss in reducing interproximal plaque and interproximal gingival inflammation. Their results indicated that the Floss Plus easy flosser is as effective as hand-held floss in reducing interproximal plaque and gingivitis.

On the contrary to **Pucher et al** and in accordance with our study, **Kleber et al** in 1995 further surveyed the study by **Pucher et al** (1990) and demonstrated that the floss-holding device was significantly more effective in helping patients establish a long-term regular flossing habit.¹⁶

Blanck et al in 2007 did a similar analysis and confirmed that the Floss Pick product was “at least as good as” the standard floss product for plaque removal.

It is important to know that when one is assessing the effectiveness of interdental cleaning methods, two points of reference should be considered. The first is the theoretical effectiveness of the method which is based on clinical evidence and second point is the practical efficacy influenced by the acceptability of method by the patients and, therefore, their compliance.³In the present study the patient compliance with floss with holder may be superior to patient compliance with adequate brushing and floss without holder.

Since both groups used similar brushing methods and brush types, we could predict that there would not be any significant differences in either method. However, in the brush-floss with handle method, accessibility and subsequently penetration in the interdental areas, the plaque surface layers were being eliminated due to the usage of dental floss with holder.

Limitations: This study was done on dental students who have sufficient skills in using a toothbrush and dental floss; the findings would be more generalizable if the sample included people from the general population.

The study subjects were only instructed to follow the instructions but monitoring it was beyond the control of the examiner. So, there might be some misdeed in the way the subjects follow their respective instructions. Further, there was a chance that the efficacy of using and handling of dental floss would be more evident if this study was done on people with improper contacts between their

teeth, which causes food impaction. Also this study was one month study so longitudinal study needs for the proper evaluation of efficacy of flossing with holder.

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