



## Comparison between the Effectiveness of Dental Tape, Flosser and Superfloss in Controlling Interproximal Biofilm: A Randomized Clinical Study

Paulo Sergio Gomes Henriques\* and Isabelle Fernandes Vieira Da Silva

Department of Dental Sciences, Anhanguera University, Campinas, SP, Brazil

\*Corresponding author: Paulo Sergio Gomes Henriques, Department of Dental Sciences, Anhanguera University, Campinas, SP, Brazil;

E-mail: phenriques@mpc.com.br

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### Abstract

**Background:** The most effective way to control gingivitis and periodontitis is biofilm mechanical removal. The aim of this randomly clinical study was to compare the efficacy of three different methods of controlling interproximal biofilm: dental tape, dental floss holder (flosser) and super floss.

**Methods:** The study consisted of 15 patients treated at faculty Sao Leopoldo Mandic who were evaluated at bleeding and plaque index in all five phases of the research, received instructions to use brushing bass method as well as the correct way to practice interproximal cleaning with the three different methodologies. The volunteers were drawn in group A (5 participants) performed the cleaning of the interproximal space with dental tape, group B (5 participants) with a flosser, and group C (5 participants) with super floss. At the 15 subsequent days, groups A, B and C, through a new randomized drawing, received their next method for cleaning the interproximal. There was a 15 days washout period between the second method and the third, in which the volunteer could choose to use the cleaning method they preferred among the two previously used.

**Results:** The variance analyses for randomized blocks indicated a statistically significance difference in plaque index ( $p < 0,001$ ) and bleeding index ( $p = 0,011$ ), better to flosser, compared others. During the washout period, the most of volunteers opted by flosser, reporting great ease and practicality.

**Conclusions:** Despite the bleeding and plaque index reduction with the different devices, the dental floss holder (flosser) is a viable alternatives to manual flossing, still being preferred by volunteers.

**Keywords:** Biofilm; Oral hygiene; Plaque control; Interdental clear

### Introduction

Dental plaque accumulation is the primary etiological factor of the diseases that are shown in the oral cavity, as caries, gingivitis, and periodontitis. Dental plaque is a biofilm structure and consists of complex microbial communities. This structure is not easily or sufficiently removed from the surfaces by natural cleaning process. The most effective way to control the growth of biofilm is the mechanical removal [1,2].

A patient's ability to achieve good mechanical plaque control is vitally important. Today, although tooth brushing is the most common method of mechanical plaque removal, we may still not be very good at it. In adults with gingivitis, self-performed mechanical plaque removal with a manual toothbrush was not sufficiently effective. The reality is that brushing alone may only remove up to 60% of overall plaque at each episode of cleaning. Brushing is also thought to be more optimal for cleaning facial surfaces of teeth compared to interproximal surfaces. This is significant because interdental sites present the highest risk of plaque accumulation, whether anteriorly or posteriorly in the mouth. Thus, interproximal surfaces of molars and premolars, being the predominant sites of residual plaque, are at higher risk of developing periodontal lesions and caries. Clinically, gingivitis and periodontitis are usually more pronounced in interproximal areas than facial aspects [3].

In western countries, the use of toothbrushes and interdental instruments in combination has become widespread, and this has a highly preventive effect against dental caries and periodontal disease. Due to increased interest in oral hygiene and periodontal disease, consciousness of plaque control has recently improved, and the market share of interdental instruments has expanded. Several studies have compared the effects of various types of interdental instruments on plaque control [4].

Periodontitis is the most common chronic inflammatory non-communicable disease of humans. According to the Global Burden of Disease 2010 study, the prevalence (1990–2010) of severe periodontitis was 11.2 %, representing the sixth-most prevalent condition in the world and the milder forms of periodontitis may be as high as 50%. On a global scale, periodontitis is estimated to cost \$54 billion in direct treatment costs and a further \$25 billion in indirect costs. Periodontitis contributes significantly to the cost of dental diseases due to the need to replace teeth lost to periodontitis. The total cost of dental diseases, in 2015, was estimated to be of \$544.41 billion, being \$356.80 billion direct costs, and \$187.61 billion indirect costs. Supragingival dental biofilm control (by patient) with interdental brushes has been recommended and professional oral hygiene instructions should be provided to reduce plaque and gingivitis. One systematic review found evidence for a significantly better cleaning effect of interdental cleaning devices as adjuncts to tooth brushing alone, and a significantly better cleaning effect of interdental brushes than of floss. Therefore, if anatomically possible, should be recommending [5].

To compare the use of an interdental brush and dental floss for controlling the dental biofilm around teeth and implants, twelve volunteers were randomly selected. A Plaque Index (PI) was done. During all period of the study, patients practiced the conventional Bass method. At the first thirty days dental tape was used. At the end of this month, a new PI was measured. At the beginning of the second month, the patients instructed to use only interproximal brushes. At the end of this second month, a new PI measured. The analysis of variance for randomized blocks revealed a significant difference in the effectiveness of the two cleaning methods used for controlling the interproximal biofilm ( $p=0.023$ ), showing that the PI was significantly lower (39,6%) with the interdental brush than with dental floss was used (58.3%) [6].

Routine use of dental floss is low, ranging between 10% and 30% among adults. The low compliance observed among adults could be because flossing is a technically challenging task. Studies showed that few individuals floss correctly and patients find flossing difficult, especially in areas with tight contact points. Consequently, it was found that unsupervised flossing does not result in substantial reductions in gingival inflammation. A meta review in 2015, which states that most available studies fail to demonstrate the effectiveness of flossing in plaque removal, potentially due to technical difficulty or lack of patient compliance. Despite substantial evidence citing a lack of support for the effectiveness of flossing in plaque removal, flossing may still confer benefits. For patients lacking dexterity or compliance, floss holders represent a potential alternative. Studies demonstrated similar results of floss holders compared to handheld floss in reducing interproximal plaque and gingivitis. They may also benefit patients lacking the dexterity to use hand floss. Further, floss holders are significantly more effective in helping patients establish a long-term flossing habit, with floss holder users more likely to floss than hand-flossers. Quality assurance and continuing competence programs to dental hygienists can provide better patient's results [7].

The superiority of interdental brushes over floss is also apparent in patients undergoing periodontal maintenance. This was demonstrated by two studies, which showed that Interdental Brushes (IDBs), when used as an adjunct to tooth brushing are more effective in proximal plaque removal than floss [8-9].

Flossing has been shown to be effective in cleaning interproximal surfaces of teeth from the contact point to the sulcus and has not been shown to produce unfavorable consequences. The ADA has reported that flossing is capable of removing up to 80% of plaque interdentally in a "normal" dentition, meaning that "the interdental space is filled with gingival papilla." Studies have shown that both plaque and gingivitis scores are reduced when patients incorporate flossing into their tooth brushing home care regimen. As periodontal disease most commonly affects the interproximal sites, it is important that these areas benefit from a concentrated effort in home care regimens, and a recent review concluded that floss holders, interproximal brushes, and power flossers had all demonstrated plaque-removal ability and reduction of gingival inflammation to the same degree as manual flossing [10].

A cross-over study involving 30 adults compared the use of manual flossing to another manual floss holder device and measured plaque removal, bleeding and gingival response, safety, and study subject satisfaction. All clinical outcome measures, plaque, bleeding and gingival indices, showed significant improvements but again there were no significant differences between the test and the manual floss group. There was no apparent trauma in either group and no difference

in satisfaction between the two methods. It was noted, however, that the floss holding device was preferred to the manual method [11].

Today several types of flosses are available. While waxed floss is generally recommended to individuals with tight interproximal contacts, un-waxed floss is suitable for the normal tooth contacts since it slides through the contact area easily. Different materials and floss designs also make it possible to clean around braces and fixed partial dentures (super floss). However, most of the people find flossing difficult and time consuming. To make flossing easier, disposable floss holders have been introduced [12].

The relative effectiveness of waxed dental floss, dental tape and Super floss as proximal plaque removal aids were compared in 20 subjects. Each subject used each of the three interdental aids for 1 week. The order of use was randomly selected. Interdental plaque scores were recorded at baseline, weeks 1, 2 and 3. At the end of week 3, subjects answered a questionnaire to ascertain their subjective responses to the 3 types of dental floss they had used. The use of all 3 types of dental floss resulted in significant improvement in interproximal plaque scores compared to baseline scores. Improvement in plaque scores, in decreasing order were: dental tape, dental floss and super floss. Subjective responses indicated that 50% of subject's preferred dental tape, 40% waxed dental floss and only 10% preferred Super floss [13].

## Methods

Initially, the first Bleeding Index (BI) and Plaque Index (PI) were taken. During the first 15 days of the study, the 15 participants used the conventional method of Bass and a group A (5 participants) performed the cleaning of the interproximal space with dental tape, group B (5 participants) performed the cleaning of the interdental space with a flosser, and the other group C (5 participants) cleaned the interproximal space with super floss. At the end of this period, a second BI and PI was collected and, in the 15 subsequent days, groups A, B and C, through a new randomized drawing, received their next method for cleaning the interproximal space, always continuing to use the method of Bass. At the end of this period a third BI and PI index was collected. There was a 15 days washout period between the second interproximal cleaning method and the third, in which the volunteer could choose to use the cleaning method they preferred among the two previously used. After the washout period, the participants of the 3 groups received the interproximal cleaning method not yet drawn, that is, what remained undrawn. And after the washout period, the fourth BI and PI index was measured. The BI and PI were also measured in the fifth period, that is, after the patients had used the last method of interproximal cleaning. To measure the BI, a periodontal millimeter probe (PCP 12) was used, which was placed in the gingival sulcus, in order to measure whether or not there was bleeding in the area of the tooth in question, which could be V, D, M, P/L.

## Results

The variance analyses for randomized blocks indicated a statistically significant difference in plaque index ( $p<0,001$ ) and bleeding index ( $p=0,011$ ), better to flosser, compared others. During the washout period, the most of volunteers (60%) opted for flosser, reporting great ease and practicality.

## Discussion

The experimental gingivitis study produced a universal principle that bacterial plaque is essential to the initiation of gingivitis and, if unresolved, would lead to periodontitis. The homecare regimens for mechanical plaque removal are important to managing gingivitis and periodontitis [14]. In artificial teeth in jaw model was evidenced that, the rate of plaque removal with finger winding floss was significantly higher than with holder floss in all regions and although finger winding floss has a disadvantage in terms of ease of holding, the plaque removal was high.

Currently, the control of interproximal plaque is key in the prevention of gingivitis and periodontitis. An important tool for this process is the daily use of dental floss or tape. The literature has highlighted the fundamental role that flosser/flosspick plays in this regard. The study presented here corroborates that the appliances that support dental floss have an excellent reduction in the interdental plaque index and, due to their practicality; they bring better patient collaboration in a biofilm control program, translating into a better response to the reduction of periodontal diseases.

## Clinical relevance

The most effective way to control of biofilm is the mechanical removal. Clinically, gingivitis and periodontitis are more pronounced

in interproximal. A patient's ability to achieve plaque control in this area is vitally important, but the low compliance could be because flossing is a technically challenging task. This randomized trial compared efficacy and practicality of dental tape, dental floss holder (flosser) and superfloss and showed that flosser is a viable alternative to manual flossing, still being preferred by volunteers. For patients lacking dexterity, floss holders represent a potential alternative to reduce interdental bleeding.

The our clinical research between the effectiveness of different interproximal cleaning methods (dental tape, flosser and superfloss) for the control of biofilm, which was measured through plaque and bleeding indexes, showed that the flosser apparatus, which consists of a supported tape for a small plastic handle, presented a better result in relation to the initial indexes (Tables 1 and 2) and the indexes after the use of the other apparatuses used. This result is understood by noting that flosser makes the interproximal cleaning process more practical, since it does not require as much manual dexterity when compared to dental tape and superfloss.

| Plaque index                    | MEAN  | SD    |
|---------------------------------|-------|-------|
| Baseline                        | 51,6% | 15,6% |
| Flosser                         | 30,6% | 13,5% |
| Superfloss                      | 38,6% | 13,3% |
| Dental tape                     | 41,9% | 13,9% |
| O'Leary Plaque Index (PI), 1972 |       |       |

**Table 1:** Mean and Standard Deviation (SD) referring to baseline plaque index of flosser, superfloss and dental tape.

| Bleeding index                | MEAN  | SD    |
|-------------------------------|-------|-------|
| Baseline                      | 36,7% | 18,1% |
| Flosser                       | 25,4% | 12,0% |
| Superfloss                    | 26,8% | 9,8%  |
| Dental tape                   | 30,1% | 14,5% |
| Gingival Bleeding Index, 1974 |       |       |

**Table 2:** Mean and Standard Deviation (SD) referring to baseline bleeding index of flosser, superfloss and dental tape.

The main problem encountered by patients for interproximal cleaning is, however, capacity and motivation. Patients find it difficult to pass dental tape, especially where there are tight contact points, and therefore interdental cleaning does not readily become an established part of daily oral hygiene. However, these difficulties are alleviated when the patient is instructed on how to correctly use the apparatus, although the problem may still persist due to lack of manual dexterity [15], but more randomized controlled clinical trials are needed to have

stronger evidence of the importance of interproximal cleaning. This corroborates with the present study that we carried out, which shows in a randomized clinical study the effectiveness of interproximal cleaning methods through dental tape, flosser and superfloss in terms of decreasing the plaque index and consequently the bleeding index (Tables 1 and 2).

The optimization of the plaque index is essential for the success of periodontal therapy, which is also in line with our study, which highlights the importance of plaque control to reduce the bleeding rate, consequently leading to the control of inflammation, resulting in

better results in the medium and long term. Other article reported that the analysis of variance for randomized blocks led to a significant difference in the efficacy of interproximal biofilm control between the two methods (interdental and dental floss), with an index significantly less plaque (39.6%) with the interdental brush than with flossing. This is in line with the research we carried out directly linked to interproximal cleaning with three distinct methods aimed at the thought of dental tape, where the flosser (dental floss holder) showed significant statistical results in decreasing the plaque index.

Flosser demonstrates its ability to reduce biofilm and consequently gingival inflammation, as demonstrated in this study, in which flosser showed a better result both in relation to the control of the bleeding index and the index of plate when comparing with the initial indexes.

| Method      | Volunteers | Percentage (%) |
|-------------|------------|----------------|
| Flosser     | 9          | 60%            |
| Superfloss  | 1          | 6.60%          |
| Dental Tape | 5          | 34%            |

**Table 3:** Preference of volunteers regarding the chosen method during the washout period.

A research showed the relative effectiveness of waxed dental floss, dental tape and superfloss as proximal plaque removal aids were compared in 20 subjects. Subjective responses indicated that 50% of subject's preferred dental tape, 40% waxed dental floss and only 10% preferred superfloss. Our study confirms this same find about superfloss, who got the worst results (Tables 1 and 2). In the washout period of our study experienced by all volunteers, most of them had a predilection for choosing the flosser during this 15 days period. This choice by the volunteers is explained by the ease they found when using the flosser, making interdental cleaning more practical when using it, not requiring greater skill to wrap the dental tape on the fingers and handle it, just hold the apparatus handle and make simpler movements on the interdental surfaces.

## Conclusion

Despite the bleeding and plaque index reduction with the different devices, the dental floss holder (flosser) is a viable alternatives to manual flossing, still being preferred by volunteers.

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This confirms that flosser was at least as efficient as conventional yarn. In our research, flosser was more effective in controlling plaque than in controlling it with the use of dental tape (flosser: 30.6% and dental tape: 41.9% of plaque index).

Other study compared the percentage of plaque removal with three different instruments for interdental use, namely: dental floss, interproximal brush and dental floss holder (flosser) and showed that the control is different in different oral regions and it also shows that floss had the best plaque indexes, despite the fact that it was easier to use flosser. In this regard, our study also showed, through a questionnaire and represented in Table 3, the preference for flosser by patients who reported greater ease of use.