



Research Article

## Comparison between the effectiveness of Dental tape, Flosser®, and Superfloss® in controlling interproximal biofilm: A randomized and clinical study

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### ABSTRACT

**Objectives:** The most effective way to control gingivitis and periodontitis is biofilm mechanical removal. The aim of this randomized and clinical study was to compare the efficacy of three different methods of controlling interproximal biofilm: Dental tape, Dental floss holder (Flosser®), and Superfloss®.

**Materials and Methods:** This study consisted of 15 volunteers of both genders, with ages between 18 and 50 years who presented at Dental School São Leopoldo Mandic, having sufficient motor skills for the oral hygiene with plaque index greater than 20%. All participants received instructions to brush using Bass technique as well the correct way to practice interproximal cleaning. The bleeding index (BI) using the periodontal millimeter probe and the plaque index (PI) through disclosing agents were taken in the five phases of the study (baseline, 15,30,45 and 60 days). The 15 volunteers were randomly divided in three Groups with three specific apparatus (A-Dental tape, B-Flosser®, and C-Superfloss®). At the 15 subsequent days, Groups A, B, and C, through a new randomized drawing, received an original tool. There was a 15-day Washout period between the second and the third method, in which the volunteer could choose to use the cleaning apparatus they preferred among the two previously used.

**Results:** The variance analyses for randomized blocks indicated a statistically significant difference in plaque index ( $P < 0.001$ ) and bleeding index ( $P = 0.011$ ), with Flosser®, compared to others. During the washout period, most volunteers opted for Flosser®, reporting great ease and practicality.

**Conclusion:** Despite the bleeding and PI 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 diseases 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 by mechanical removal.<sup>[1,2]</sup>

A patient's ability to achieve good mechanical plaque control is vitally important. Although tooth brushing is the most common method of mechanical plaque removal, patients may still not be very good at it. In adults with gingivitis, self-performed mechanical plaque removal with

a manual toothbrush may not be 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 in facial aspects.<sup>[3]</sup>

In Western countries, the use of toothbrushes and interdental instruments in combination has become widespread, and this has a high 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.<sup>[4]</sup>

Periodontitis is the most common chronic inflammatory non-communicable disease in 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 results in significant cost from dental diseases due to the need to replace teeth lost due to periodontitis. The total cost of dental diseases, in 2015, was estimated to be \$544.41 billion, \$356,80 billion direct cost and \$187.61 billion indirect cost. Supragingival dental biofilm control (by patient) with interdental brushes (IDBs) 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 IDBs than of floss. Therefore, if anatomically possible, we recommend that tooth brushing should be supplemented by the use of interdental brushes.<sup>[5]</sup>

To compare the use of an interdental brush and dental floss for controlling the dental biofilm around teeth and implants, 12 volunteers were randomly selected. A plaque index (PI) was done. During all periods of the study, patients practiced the conventional Bass method. In the first 30 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 were instructed to use only interproximal brushes. At the end of this second month, a new PI was 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 (58.3%).<sup>[6]</sup>

Routine use of dental floss is low, ranging between 10% and 30% among adults.<sup>[7]</sup> 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, 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.<sup>[3]</sup> Quality assurance and continuing competence programs for dental hygienists can provide better patient results.<sup>[7]</sup>

The superiority of IDBs over floss is also apparent in patients undergoing periodontal maintenance. This was demonstrated by two studies, which showed that IDBs when used as an adjunct to tooth brushing is more effective in proximal plaque removal than floss.<sup>[8,9]</sup>

Flossing is 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 homecare regimen. As periodontal disease most commonly affects the interproximal sites, these areas must benefit from a concentrated effort in homecare 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.<sup>[10]</sup>

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.<sup>[11]</sup>

Today, several types of flosses are available. While waxed floss is generally recommended for individuals with tight interproximal contacts, unwaxed 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 (Superfloss®). However, most of the people find flossing difficult and time consuming. To make flossing easier, disposable floss holders have been introduced.<sup>[12]</sup>

The relative effectiveness of waxed dental floss, dental tape, and Superfloss® as proximal plaque removal aids was compared in 20 subjects. Each subject used each of the three interdental aids for one 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 three types of dental floss they had used. The use of all three types of dental floss resulted in significant improvement in interproximal plaque scores compared to baseline scores. Improvement in plaque scores in decreasing order was dental tape, dental floss, and Superfloss®. Subjective responses indicated that 50% of subjects preferred dental tape, 40% waxed dental floss, and only 10% preferred Superfloss®.<sup>[13]</sup>

## MATERIALS AND METHODS

This study was approved by the Research Ethics Committee (CAAE 29376820.8.0000.5374) and consisted of 15 volunteers, of both genders, with ages between 18 and 50 years who present at Dental School São Leopoldo Mandic, having sufficient motor skills for the oral hygiene suggested and with plaque index greater than 20%. All participants received instructions to use brushing Bass method as well the correct way to practice interproximal cleaning. The bleeding index (BI) using the periodontal millimeter probe and the plaque index (PI) through disclosing agents were taken in the five phases of the study (baseline, 15,30,45 and 60 days). Randomly, the 15 volunteers were divided in three Groups with three specific apparatus (A-Dental tape, B-Flosser®, and C-Superfloss®). At the 15 subsequent days, Groups A, B, and C, through a new randomized drawing, received an original tool. There was a 15-day Washout period between the second and the third method, in which the volunteer could choose to use the cleaning apparatus they preferred among the two previously used.

## RESULTS

The variance analyses for randomized blocks indicated a statistically significance difference in PI ( $P < 0.001$ ) and BI ( $P = 0.011$ ), better than Flosser®, compared to others. During the washout period, the most of volunteers (60%) opted by 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.<sup>[1]</sup> The homecare regimens for mechanical plaque removal are important to managing gingivitis and periodontitis.<sup>[14]</sup> The rates of plaque removal with finger-winding floss in the maxilla and mandible were significantly higher than those with holder floss. This may have been because finger-winding floss allows greater freedom in direction of movement. On the other hand, the direction of brushing in interdental regions with holder floss is likely to be limited, which may result in plaque being left unremoved in specific regions, although this type of instrument has an advantage over finger-winding floss in terms of ease of holding.<sup>[4]</sup>

Our clinical research on the effectiveness of different interproximal cleaning methods (dental tape, Flosser®, and Superfloss®) for the control of biofilm [Figure 1], which was measured through plaque and BIs, 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 apparatus used [Tables 1 and 2]. 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®.

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

**Table 1:** Mean and standard deviation referring to baseline plaque index of Flosser®, Superfloss®, and dental tape.

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 2:** Mean and standard deviation referring to baseline bleeding index of Flosser®, Superfloss®, and Dental tape.

Bleeding index	Mean (%)	SD (%)
Baseline	36.7	18.1
Flosser®	25.4	12
Superfloss®	26.8	9.8
Dental tape	30.1	14.5

Gingival bleeding index, 1974

problem may persist due to lack of manual dexterity,<sup>[15]</sup> but more randomized, controlled, and clinical trials are needed to have stronger evidence of the importance of interproximal cleaning.<sup>[12]</sup> This corroborates with the present study that we carried out, which shows in a randomized and clinical study the effectiveness of interproximal cleaning methods through dental tape, Flosser®, and Superfloss® in terms of decreasing the PI and consequently the BI [Tables 1 and 2].

The optimization of the PI 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.<sup>[3]</sup> Another 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 of 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 PI.<sup>[6]</sup>

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 BI and the index of plate when compared with the initial indices.<sup>[7]</sup> 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% – percentage of PI).

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 PIs, despite the fact that it was easier to use Flosser®.<sup>[4]</sup> 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.

A research showed the relative effectiveness of waxed dental floss, dental tape, and Superfloss as proximal

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

Method	Volunteers	Percentage
Flosser®	9	60
Superfloss®	1	6.6
Dental tape	5	34



**Figure 1:** Different types of interdental cleaning tools used in research (Superfloss® – Oral B) (Dental tape – Oral B) (Flosser – GUM).

plaque removal aids in 20 subjects. Subjective responses indicated that 50% of subjects preferred dental tape, 40% waxed dental floss, and only 10% preferred Superfloss®. Our study confirms this same finding about Superfloss, which got the worst results [Tables 1 and 2].<sup>[13]</sup> In the washout period of our study experienced by all volunteers, most of them had a predilection for choosing the Flosser® during these 15 days. 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 PI reduction with the different devices, the dental floss holder (Flosser®) is a viable alternative to manual flossing, still being preferred by volunteers.

**Declaration of patient consent**

The authors certify that they have obtained all appropriate patient consent.

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Nil.



## Conflicts of interest

There are no conflicts of interest.

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