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Original Research Paper

Comparison of the Efficiency in Plaque Removal between Water Jet and Conventional Interdental Floss

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Background: In order to maintain good oral hygiene and prevent periodontal disease, it is important to remove dental plaque; this could not be achieved by using the toothbrush alone, it needs the help of interdental aids or intra-oral irrigator devices. The objective of this study was to analyze the importance and differences between water jet and interdental flossing and to improve awareness among individuals. Materials and methods: Sixty subjects were enrolled in a randomized convince sampling method, using a split-mouth design such that half of the mouth will be cleaned with dental floss and the other half will be washed with water jet. We divided our sample size into four sub-groups (Healthy periodontium/Gingivitis/Periodontitis/Prosthesis (including crown, implant, and fixed retainers) with 15 subjects for each subgroup. Results: After the examination, the plaque index was reduced in all groups especially in the prosthesis group with the use of water jet. Conclusion: Waterpik flosser shows better effectiveness in reducing dental plaque than dental floss and brushing.

Keywords: Efficacy, plaque removal, water jet, interdental floss.

INTRODUCTION

Daily removal of dental plaque biofilm is important to maintain healthy gingiva and prevent gingivitis and periodontitis, (1) because this biofilm contains the bacteria responsible for caries formation and the development of gingivitis and periodontitis (2). The most common device used for mechanical plaque control is the toothbrush. Traditional toothbrushing powered or manualwill removes the supragingival plaque from tooth surfaces, when done properly and thoroughly (Sarlati et al., 2016).

Tooth brushing and flossing have been considered the standard for routine plaque removal and gingivitis reduction. The most effective and efficient way of removing interproximal plaque and decreasing interdental gingival inflammation is by using dental floss. However, there are several powered products that are available now on the market such as water jets that are designed to clean the areas between the teeth that the toothbrush cannot reach (Sharma, N. C., Lyle, D. M., Qaqish, J. G., & Schuller, R. 2012). A dental water jet is an electric device that delivers a pulsating fluid via controlled pressure which is aimed at the removal of interdental and subgingival plaque biofilm on tooth surfaces to reduce inflammation as a supplement to tooth brushing (Rosema, N. A., Hennequin-Hoenderdos, N. L., Berchier, C. E., Slot, D. E., Lyle, D. M., & van der Weijden, G. A. 2011).

There are many types of water jet available, some are continuous stream devices while other have pressure and pulsation characteristics.

The daily use of water jet has been shown to reduce dental plaque, calculus, gingivitis, bleeding, probing depth, periodontal pathogens, and host inflammatory mediators (Barnes, C. M., Russell, C. M., Reinhardt, R. A., Payne, J. B., & Lyle, D. M. 2005).

MATERIALS AND METHODS

Study Design

Sixty subjects were enrolled in a randomized convince sampling method using a split-mouth design such that half of the mouth will be cleaned with dental floss and the other half

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will be washed with a water jet. We divided our sample size into 4 sub-groups (Healthy periodontium / Gingivitis / Periodontitis / Prosthesis (including crown, implant, and fixed retainers)) with 15 subjects for each subgroup. Subjects were examined in the dental clinics in Riyadh Elm University and the dental plaque was assessed and evaluated before and after cleaning. They were scored using plaque index (Sinless and Loe 1964) after using a disclosing solution. Plaque index was evaluated for each patient according to the following steps and the teeth that are examined are the Ramfjord teeth or their substitution. Examiners are fixed to rule out variation in the recording.

Patients first used Visuplac disclosing solution and the amount of plaque in Ramfjord teeth was scored approximately in percentage. Patients were given toothbrushes and toothpaste to brush their teeth and disclosing solution was used after to record the plaque after brushing. Teeth were examined and scored again.

Patients used Oral B unwaxed interdental floss tooth #16,41,44 and Waterpik battery operated water flosser was used on tooth #21,24,36. Patients again used disclosing solution so that the Ramfjord teeth were examined for the last time. All scores were encoded in SPSS and Microsoft excel

RESULTS

In this study, we examined 60 patients, all the patients were females as the study was conducted in the female's campus of the Riyadh Elm University. The majority of the sample brush their teeth twice per day (85%), followed by once per day (11.7%). While the highest frequency of flossing was once per day (46.7%), followed by random flossing (30%). On the other hand, the highest frequency of using water jet was once per day (26.7%), followed by random use (11.7%). 0% of the examined sample didn't brush at all, 16.7% of the sample didn't floss at all, and 60% never used the water jet.

Comparing the means of the residual plaque percentages in the healthy gingiva group, it was found that after flossing, the mean was 16.88% (± 12.26%), with the mean difference between the first reading before intervention and the final reading after intervention being 10.26%. While the mean after the use of water jet was 4.88% (± 5.61%) with the mean difference between the first and final readings being 13.33%. As for the gingivitis group, it was found that after flossing, the mean was 17% (± 11.67%), with the mean difference between the first and final readings being 19.88%. While the mean after the use of water jet was 7.22% (± 6.86%), with the mean difference between the first and final readings being 17.44%. And for the periodontitis group, it was found that after flossing the mean was 15.44% (± 8.22%), with the mean difference between the first and final readings being 14.22%.

While the mean after the use of water jet was 7.48% (± 8.15%), with the mean difference between the first and final readings being 16.95%. Finally, for the prosthesis group, it was found that after flossing the mean was 20.33% (± 13.33%), with the mean difference between the first and final readings being 17.88%. While the mean after the use of the water jet was 8.66% (± 8.45%), with the mean difference between the first and final readings being 23.88%. With all the differences being statistically significant between the groups ($P < 0.05$). (Table 1).

Comparing the efficiency of using the floss and water jet, it was found that the use of the water jet was more efficient in the removal of dental plaque in all the groups when compared to the use of dental floss. With the highest difference between the means observed in the healthy gingiva group being 12% ($P < 0.05$), followed by the prosthesis group with 11.67%, the gingivitis group with 9.78%, and finally the periodontitis with 7.96%. The Pearson test showed a direct correlation between the dental floss and the water jet in all the groups. (Table 2).

Comparing the efficiency of plaque removal in different teeth using the dental floss and water jet, it showed that water jet was more efficient in all the teeth compared to the dental floss. In the healthy gingiva group and the prosthesis group, the central incisors showed the lowest residual plaque means at 3.33% (± 5.87%) and 7.66% (± 9.23%) respectively. In the gingivitis group, the 1st molars showed the lowest mean at 4% (± 5.41%). Finally, in the periodontitis group, the 1st premolars showed the lowest mean at 3.66% (± 3.51%)(Table 3).

DISCUSSION

Individuals tend to miss the proximal and marginal dental areas. The adjunctive use of an interdental cleaner is necessary to clean the hard-to-reach interdental areas and proximal surfaces of the teeth. To prevent plaque build-up and bacteria sticky film on teeth, proper oral hygiene maintenance is required. Tooth brushing alone cannot remove all the dental plaque from dental surfaces, even when done correctly and thoroughly. Dental floss is considered the "gold standard" of interdental care (Sarlati et al., 2016).

The present study evaluated the plaque removal efficiency of waterjets. The results showed that this simple water flosser is more effective in reducing plaque on areas that are often difficult to floss.

In this study, we compared the efficacy of plaque removal by dental floss and waterjet. Significant reduction in plaque percentage was seen with the use of waterjet which agrees with a researcher who found that the use of waterjet alone or as adjunctive to tooth brushing showed a superior equivalent reduction in plaque accumulation. Deinzer, R., Jahns, S., & Harnacke, D. (2014) Benson, B. J., Henyon, G., Grossman, E., Mankodi, S., & Sharma, N. C. (1993).

Water jet instructions were strictly followed, while the flossing depended on their own knowledge. We observed that the water jet was more efficient in all the teeth compared to the dental floss.

A significant reduction in plaque percentage was seen in the prosthesis group, which agree with the study done previously and found the same result which showed that using the dental water jet increased plaque removal. The investigators also found that the subjects who had the best results had either fixed bridgework or crowns (Krajewski JJ, Giblin J, Gargiulo AW (1964), Jahn C. A., (2010)).

Oral irrigation and manual brushing removed plaque as well as manual brushing and flossing on lingual surfaces, while oral irrigation plus power brushing was statistically better than manual brushing and flossing on facial surfaces (Barnes, C. M., Russell, C. M., Reinhardt, R. A., Payne, J. B., & Lyle, D. M. (2005)).

Finally, none of the techniques gave 0% residual plaque, while using both waterjet and tooth brushing might be more efficient.

Table 1: Comparison of the groups before brushing, after brushing, and after flossing/water jet

Group	Mean	Std. Dev.	Sig.	Sig. Within Groups		
				Groups	Mean Dif.	Sig
1- Healthy – Before Brushing 2- Healthy – After Brushing Only 3- Healthy – After Flossing	27.15% 24.6% 16.88%	15.02% 13.25% 12.26%	0.000	1 – 2 1 – 3 2 – 3	2.55% 10.26% 7.71%	0.030 0.000 0.001
1- Healthy – Before Brushing 2- Healthy – After Brushing Only 3- Healthy – After Water Jet	18.33% 14.88% 4.88%	13.54% 11.8% 5.61%	0.000	1 – 2 1 – 3 2 – 3	3.44% 13.33% 10%	0.023 0.000 0.000
1- Gingivitis – Before Brushing 2- Gingivitis – After Brushing Only 3- Gingivitis – After Flossing	36.88% 25.55% 17%	19.67% 12.88% 11.67%	0.000	1 – 2 1 – 3 2 – 3	11.33% 19.88% 8.55%	0.010 0.000 0.001
1- Gingivitis – Before Brushing 2- Gingivitis – After Brushing Only 3- Gingivitis – After Water Jet	24.66% 16.11% 7.22%	15.27% 12.82% 6.86%	0.000	1 – 2 1 – 3 2 – 3	8.55% 17.44% 8.88%	0.000 0.000 0.002
1- Periodontitis – Before Brushing 2- Periodontitis – After Brushing Only 3- Periodontitis – After Flossing	29.66% 22.88% 15.44%	14.36% 13.2% 8.22%	0.000	1 – 2 1 – 3 2 – 3	6.77% 14.22% 7.44%	0.001 0.000 0.004
1- Periodontitis – Before Brushing 2- Periodontitis – After Brushing Only 3- Periodontitis – After Water Jet	24.44% 18% 7.48%	16.03% 12.44% 8.15%	0.000	1 – 2 1 – 3 2 – 3	6.44% 16.95% 10.51%	0.009 0.000 0.000
1- Prosthesis – Before Brushing 2- Prosthesis– After Brushing Only 3- Prosthesis– After Flossing	38.22% 31.22% 20.33%	20.49% 18.56% 13.33%	0.000	1 – 2 1 – 3 2 – 3	7% 17.88% 10.88%	0.025 0.000 0.002
1- Prosthesis – Before Brushing 2- Prosthesis– After Brushing Only 3- Prosthesis– After Water Jet	32.55% 22.66% 8.66%	17.96% 14.66% 8.45%	0.000	1 – 2 1 – 3 2 – 3	9.88% 23.88% 14%	0.006 0.000 0.000

Table 2: Comparison of the means between the flossing and water jet

Group	Mean	Std. Dev.	Sig.	Pearson Correlation
Healthy – After Flossing Healthy – After Water Jet	16.88% 4.88%	12.26% 5.61%	0.003	0.706
Gingivitis – After Flossing Gingivitis – After Water Jet	17% 7.22%	11.67% 6.86%	0.451	0.211
Periodontitis– After Flossing Periodontitis– After Water Jet	15.44% 7.48%	8.22% 8.15%	0.153	0.388
Prosthesis– After Flossing Prosthesis– After Water Jet	20.33% 8.66%	13.33% 8.45%	0.068	0.483

Table 3: Comparison of the residual plaque between the teeth after intervention

Group	Mean	Std. Dev.	Sig.
Healthy – After Flossing Upper 1st Molar (16) Healthy – After Water Jet Lower 1st Molar (36)	25.33% 6%	27.15% 12.7%	0.000
Healthy – After Flossing Lower 1st Premolar (44) Healthy – After Water Jet Upper 1st Premolar (24)	11.33% 5.3%	10.25% 8.95%	0.031
Healthy – After Flossing Lower Central Incisor (41) Healthy – After Water Jet Upper Central Incisor (21)	14% 3.33%	12.98% 5.87%	0.451
Gingivitis – After Flossing Upper 1st Molar (16) Gingivitis – After Water Jet Lower 1st Molar (36)	21.66% 4%	20.93% 5.41%	0.537
Gingivitis – After Flossing Lower 1st Premolar (44) Gingivitis – After Water Jet Upper 1st Premolar (24)	9.33% 5.66%	7.98% 5.3%	0.010
Gingivitis – After Flossing Lower Central Incisor (41) Gingivitis – After Water Jet Upper Central Incisor (21)	20% 12%	19.08% 27.29%	0.177
Periodontitis – After Flossing Upper 1st Molar (16) Periodontitis – After Water Jet Lower 1st Molar (36)	15% 6.8%	8.23% 9.1%	0.486
Periodontitis – After Flossing Lower 1st Premolar (44) Periodontitis – After Water Jet Upper 1st Premolar (24)	12% 3.66%	11.3% 3.51%	0.299
Periodontitis – After Flossing Lower Central Incisor (41) Periodontitis – After Water Jet Upper Central Incisor (21)	19.33% 12%	18.5% 21.11%	0.011
Prosthesis – After Flossing Upper 1st Molar (16) Prosthesis – After Water Jet Lower 1st Molar (36)	25.33% 7.66%	22.23% 12.51%	0.313
Prosthesis – After Flossing Lower 1st Premolar (44) Prosthesis – After Water Jet Upper 1st Premolar (24)	14.33% 10.66%	10.66% 10.83%	0.068
Prosthesis – After Flossing Lower Central Incisor (41) Prosthesis – After Water Jet Upper Central Incisor (21)	21.33% 7.66%	20.21% 9.23%	0.302

CONCLUSION

The study results show that waterjet flosser has a greater reduction of plaque than dental floss and is well accepted by patients. However, using one of these methods alone wasn't able to remove the plaque completely under all conditions. Adjunctive methods (waterjet and tooth brushing) might be more efficient for patients to remove plaque.

CONFLICT OF INTEREST

There is no conflict of interest among the authors regarding the publication.

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