Effectiveness of Super Floss and Water Flosser in plaque removal for patients undergoing orthodontic treatment; A Controlled Clinical Trial

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Introduction

Patients who wear fixed orthodontic appliances must maintain high standards of oral hygiene; otherwise, they will experience a range of complications, including decay, enamel demineralization, gingivitis, gingival hyperplasia, and periodontitis (1). Multiple studies demonstrated that using fixed orthodontic appliances can make it more challenging to maintain good oral hygiene due to the plaque accumulation around the archwires, bands, and brackets (2–4). The fixed appliance can also change the bacterial composition of the oral environment, enable bacterial plaque retention, reduce self-cleaning capabilities, and trigger gingival infection or enamel decalcification and white spot lesions with soft-tissue recession and teeth abrasion (5). Therefore, the primary objective of any oral hygiene program should be to ensure that patients are motivated to pursue good oral hygiene and that they remain compliant with their oral hygiene program throughout the treatment period (6).

Various devices are available to help orthodontic patients maintain good oral hygiene, including essential manual toothbrushes and toothpaste, electronic toothbrush, dental floss, brushes for interproximal hygiene, and oral irrigators, such as dental water floss (7). According to the American Dental Association (ADA), Water flossers have been tested to be safe and effective at removing plaques, which are associated with a higher risk for cavities and gum disease. In addition, water flosser can reduce gingivitis, the early form of gum disease (8). One of the main challenges practitioners often encounter is that orthodontic patients, most of whom are young, cannot be relied upon to engage in preventative health behavior. Furthermore, changing a patient's oral hygiene habits might be difficult. This situation can be exacerbated because orthodontic appliances can make it more challenging to maintain good oral hygiene (9). For instance, the use of string-waxed floss for interdental cleaning relies on special floss or a threading device; however, it can be time-intensive and challenging. Some studies have demonstrated that super floss achieves superior outcomes to regular waxed floss and can

enhance gingival health (10). Super floss consists of three primary elements: a strengthened-end dental floss threader that makes it easier to position the floss under the orthodontic wires, a fuzzy floss that can clean around any wide gaps, and orthodontic brackets, and standard dental floss that can eliminate plaque from under the gingival contours (11). Electric devices, such as water flosser, have also been made available to help orthodontic patients overcome some of the issues associated with the use of standard string floss while also achieving the same degree of effectiveness (12).

For instance, research by Sharma et al. (13) found that using a water flosser in combination with manual brushing decreased bleeding on probing scores by 41.2% over a period of 28 days. The pulsing action of water flosser compresses and decompresses the gingival tissue. This enables the water to the subgingival and interdental regions surrounding the tooth to remove plaque, bacteria, and debris, especially, unreachable regions by standard toothbrushes (14). Although several clinical studies have proven the benefit of water floss in reducing gingival inflammation, bleeding, and pathogenic bacteria, most of these studies focused on non-orthodontic patients such as patients with periodontal disease, patients with implants, crowns or bridges, and patients with diabetes (7,14–18). Studies investigating the efficacy of dental water floss on oral hygiene control of orthodontic patients are limited, and its impact on reducing supragingival plaque biofilm remains unclear (19). This determines the need for studying the effect of this device on an orthodontic patient sample in particular and whether it is superior or as effective compared to super floss. Hence, this randomized control trial aimed to evaluate the effectiveness of super floss (Oral-B Super Floss) and water flosser (Waterpik Cordless Freedom Water Flosser) in plaque removal in orthodontic patients.

Materials and Methods

Study design

In this single-blind, randomized, controlled, parallel clinical trial with a split-mouth protocol, we will follow the CONSORT Statement for reporting randomized trials (20). Verbal and written consents will be obtained from all included patients (see **Appendix 1**). Young adult orthodontic patients will be recruited and randomly selected with an allocation ratio of 1:1 from Riyadh Specialized Dental Center in Riyadh, Saudi Arabia.

Inclusion and Exclusion Criteria

Patients will be recruited if they are male or female between 18-35 years old who approached the end of their orthodontic treatment. Patients who are undergoing braces from the right first molar to the left first molar with pocket depth ≤ 3mm and have not used any floss type for the last 24 hours will be included. Patients with systemic diseases, craniofacial anomalies, periodontal problems, spacing or missing teeth in the examined arch, and those who are smokers will be excluded from the study.

Examiners' calibration

The two examiners will be calibrated - each independently will examine four patients using Rustogi et al. (21), Modified Navy Plaque Index (RMNPI) (see **Figure 1**).

Intervention

In a single visit, the split-mouth technique is performed to compare consistency in both groups. In addition, RMNPI is adapted to measure plaque levels of all subjects at baseline with the use of the WHO probe (21). A separate researcher will explain oral hygiene instructions to all subjects, using

the modified bass technique and a standard toothbrush (soft-bristled brush with fluoridated toothpaste) and explain to the patients the correct method of using interdental cleaning techniques manufacturer's instructions. The type of floss used will be randomly assigned to each side of the oral cavity; Super-Floss® (Oral-B) will be used on one side, while the Waterpik® water flosser will be used on the other (see **Appendix 2**). All participants will have around two minutes to brush their teeth and another two minutes to clean their interproximal teeth.

Outcome measurement

The plaque index of each side will be taken and compared with the baseline score. Examiners who are recording the plaque index before and after the trial will be blinded regarding the type of floss used for each side of the mouth). Respectively, a canine, one premolar, and one molar are selected for evaluation. Plaque is assessed for each tooth area and is scored using the following scale: 0 = absent, and 1 = present.

Sample size calculation

Based on a similar study (15), the difference between the groups was found to be 1.1 with alpha 5% and a power of 80%; the minimum expected sample was found to be thirty-four subjects.

Statistical Analysis

The collected data will be entered from the paper-based records into SPSS version 22. Categorical data will be presented as frequency and percentage and data will be analyzed using paired t-test to compare the plaque scores of each interdental aid (before and after) and to compare between the effectiveness of the two interdental aids in plaque removal from the different teeth (canine, premolar, and molar) and the different surface areas (mesial and distal). A p-value of less than 0.05 is considered significant.

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Disclosure

The author declares no conflict of interest in this work

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Appendix 1

Case no.				

Research Participation Consent Form

We are dental interns from Princess Nourah bint Abdulrahman University, College of Dentistry. We are conducting a study to assess the effectiveness of water flosser compared with regular dental floss in removing interdental plaque in patients with braces.
Your scoring will be a part of a random sample and each score is important in creating a useful analysis. Note that your personal information will not be written down.

This is how you will participate:

1- You will be asked to brush your teeth according to the instructions given by the dentist.
2- We will be asked to use two interdental aids:
   - On one side of mouth, you will use regular dental floss which is a cord of thin filaments used to remove food and dental plaque from between teeth in areas a toothbrush is unable to reach
   - On the other side, you will use water flosser which is an oral irrigation device that delivers a steady stream of water and can flush out food particles, bacteria and plaque from under the gums and between teeth

Note that there are no side effects for both methods, and enrollment in this study is free of charge.

I have read the foregoing information and I have had the opportunity to ask questions about it. Any questions that I have asked, have been answered.
I consent voluntarily to participate in this research and I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason.

Name:_____

Signature:_____

Date: _____

Thank you for your participation!

Appendix 2

Case no.				

Data Collection Form

Before implementation of oral hygiene

☐ U	☐ L	☐ Rt	☐ Lt
☐ C ☐ PM ☐ M	☐ C ☐ PM ☐ M	F: C: D: A:	F: C: D: A:
☐ C ☐ PM ☐ M	☐ C ☐ PM ☐ M	F: C: D: A:	F: C: D: A:
☐ C ☐ PM ☐ M	☐ C ☐ PM ☐ M	F: C: D: A:	F: C: D: A:

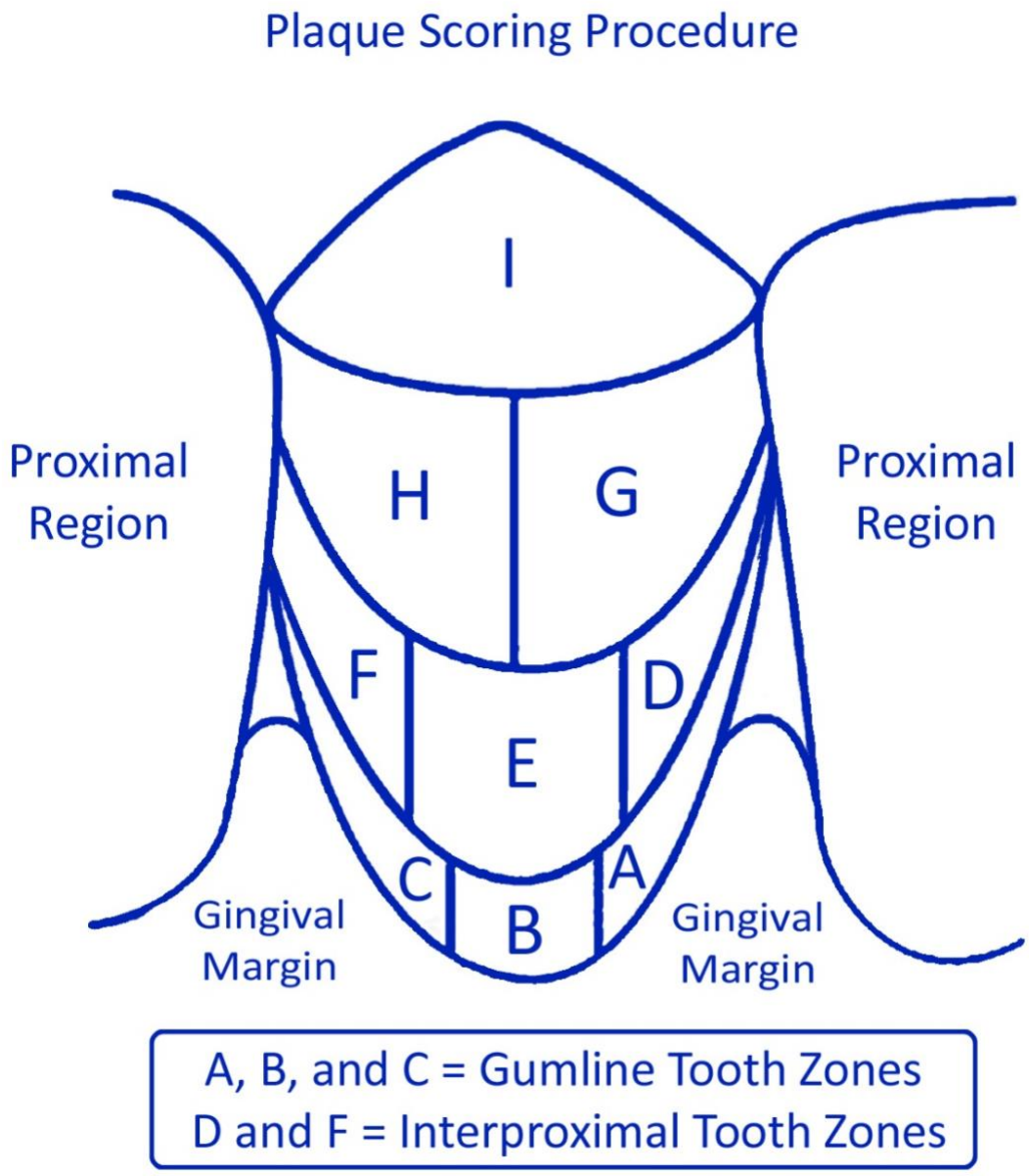
After implementation of oral hygiene

Water flosser: ☐ **Lt** ☐ **Rt**

Super floss: ☐ **Lt** ☐ **Rt**

☐ **U**	☐ **L**	☐ **Rt**	☐ **Lt**
☐ C ☐ PM ☐ M	☐ C ☐ PM ☐ M	F: C: D: A:	F: C: D: A:
☐ C ☐ PM ☐ M	☐ C ☐ PM ☐ M	F: C: D: A:	F: C: D: A:
☐ C ☐ PM ☐ M	☐ C ☐ PM ☐ M	F: C: D: A:	F: C: D: A:

Figure 1


Plaque Scoring Procedure
I
Proximal Region
H
G
Proximal Region
F
D
E
C
A
B
Gingival Margin
Gingival Margin
A, B, and C = Gumline Tooth Zones
D and F = Interproximal Tooth Zones