



Report of experiment in vitro:
Plaque biofilm removal with JETPIK Smart Floss

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February 23rd 2013

Objective: To compare the effect of plaque biofilm removal on teeth using JETPIK Smart Floss against Waterpik Water Flosser in vitro.

Instruments:

1. Waterpik: Water Flosser WP – 450 , Waterpik, USA ;
2. JETPIK: Smart Floss JP-100, Nucreatronics Electronic Technology (Shanghai) Co., LTD, China;
3. Stereo microscope: Stemi SV11, Zeiss, German

Methods :

1. To prepare a plaque culture for seeding teeth, saliva was taken from a volunteer. Fresh BHI (Brain Heart Infusion, BHI) medium was sterilized. The saliva (15ml) and the BHI medium (15ml) were mixed under aseptic conditions and incubated for 24 hrs. at 37 °C.
2. Seven completely extracted molars from patients with periodontal diseases were soaked in 5% 84 disinfectants for 24 hrs. to remove endogenous biofilm. Plaque on molars was visualised with GC Plaque disclosing gel (To coat the gel on molars for 30 seconds and rinse with the distilled water for 30 seconds). Calculus, plaque and pigment on the molars were removed with ultrasonic scaler. Then, teeth were polished with slow turbine and soaked in 5% 84 disinfectants for 24 hrs.
3. Molars were incubated with the plaque culture medium (Saliva & BHI medium) for 4 days at 37°C. Fresh BHI medium was changed daily (1:1000).
4. Plaque on molars was visualised with GC Plaque disclosing gel. One molar was randomly selected as control and named group C. Three couples of molars were selected according to plaque accumulation. Each pair of molars contains 2 teeth with similar plaque accumulation. A black dot was marked in the middle of the surface of the stained dental enamel. Teeth in these 3 pairs were numbered as J1/W1, J2/W2 and J3/W3. Each molar in group J and group W were photographed with camera and observed under a stereoscopic microscope (1.6 times, 2.5 times and 5 times magnification).

5. JETPIK Smart Floss was used according to the manufacturer's instruction for the standard jet tip. The unit was set on high-pressure. Each molar in Group J was treated at a distance of 3 mm for 5, 8, 11, 14 and 17 seconds. After each time point, the teeth were photographed with camera and observed under a Stereoscopic microscope (1.6 times, 2.5 times and 5 times magnification).

6. Waterpik Water Flosser was used according to the manufacturer's instruction for the standard jet tip. The unit was set on high-pressure. Each molar in Group W was treated at a distance of 3 mm for 5, 8, 11, 14 and 17 seconds. After each time point, the teeth were recorded with camera and observed under Stereoscopic microscope (1.6 times, 2.5 times and 5 times magnification).

7. The molar in Group C was treated with high-pressure water and air on dental treatment chair for 5, 8, 11, 14 and 17 seconds. After each time point, the teeth were recorded with camera and observed under a Stereoscopic microscope (1.6 times, 2.5 times and 5).

Evaluation:

Images of the Group C, J and W teeth were taken using the stereoscopic microscope (5 times magnification) at each time point and analysed with ImageJ2X software. The area (mm^2) of plaque biofilm was measured at each time point. Plaque biofilm removal efficiency was recorded as the percent reduction of the stained area of plaque biofilm post-treatment compared to pre-treatment for each tooth.

The percentage reduction was calculated as follows:

$$1- \frac{\text{Area of plaque biofilm after treatment}}{\text{the area of plaque biofilm before treatment}} \times 100$$

Results:

The results are shown in Table 1.

1. For Group C, there was no substantial effect on the stained area of plaque biofilm at 5, 8, 11 or 14 seconds (Figure 1)
2. For Group J the stained area of plaque biofilm gradually reduced at 5, 8, 11, 14 and 17 seconds (Figures 2-4). The average reduction ranged from $x \text{ mm}^2$ at 5 seconds to $y \text{ mm}^2$ at 17 seconds following cleaning.
3. For group W, the stained area of plaque biofilm gradually reduced at 5, 8, 11 and 14 seconds (Figures 5-7). The average reduction ranged from $x \text{ mm}^2$ at 5 seconds to $y \text{ mm}^2$ at 14 seconds following cleaning.

Discussion:

The aim of this experiment was to compare the cleaning efficiency of two electronic teeth floss devices. No reduction in plaque biofilm was observed when teeth were treated with treated with high-pressure water and air. At each time point, the Jetpik Smart Floss was resulted in approximately two-fold more efficient plaque biofilm reduction than the Waterpik Water Flosser.

Harmful bacteria can be removed from teeth by water with a certain pressure using a Waterpik Water Flosser. Its efficiency depends on the amplitude of pulse pressure. The pressure setting is limited by the sensitivity of the oral environment. An innovation was made by Jetpik Smart Floss by combining a dental floss with the pulse of water and air so that the cleaning efficiency would be significantly increased under the same pressure.

Conclusion:

The data shows that over a treatment period of up to 14 seconds on high-pressure, that JETPIK Smart Floss was approximately twice as effective at removing plaque biofilm from human teeth as Waterpik Water Flosser.

Table and Figures:

Figure 1: Treatment images for Group C

Figure 2: Treatment images for J1

Figure 3: Treatment images for J2

Figure 4: Treatment images for J3

Figure 5: Treatment images for W1

Figure 6: Treatment images for W2

Figure 7: Treatment images for W3

Table 1: The stained area of plaque biofilm before and after treatment for all groups analysed with Image J2X software.

Group	BF (mm ²)	5S (mm ²)	8S (mm ²)	11S (mm ²)	14S (mm ²)	17S (mm ²)
C	2.886	2.954	2.931	2.929	2.973	
J1	2.214	1.420 (35.9%)	0.867 (60.8%)	0.613 (72.3%)	0.523 (76.4%)	0.184 (83.1%)
J2	1.762	1.414 (19.8%)	1.149 (34.8%)	0.703 (60.1%)	0.350 (80.1%)	0.018 (99.0%)
J3	2.659	1.128 (57.6%)	0.932 (64.9%)	0.872 (67.2%)	0.542 (79.6%)	0.312 (88.3%)
W1	1.642	1.422 (13.4%)	1.324 (19.4%)	1.154 (29.7%)	1.076 (34.5%)	
W2	1.727	1.525 (11.7%)	1.374 (20.4%)	1.218 (29.5%)	1.043 (39.6%)	
W3	1.484	1.265 (14.8%)	1.126 (24.1%)	1.017 (31.5%)	0.980 (34.0%)	

Table 1: Area of plaque biofilm

	Area of plaque biofilm (mm ²)					
Time (sec)	0	5	8	11	14	17
Group						
C	2.886	2.954	2.931	2.929	2.973	N.D.
J1	2.214	1.420 (35.9%)	0.867 (60.8%)	0.613 (72.3%)	0.523 (76.4%)	0.184 (83.1%)
J2	1.762	1.414 (19.8%)	1.149 (34.8%)	0.703 (60.1%)	0.350 (80.1%)	0.018 (99.0%)
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W3	1.484	1.265 (14.8%)	1.126 (24.1%)	1.017 (31.5%)	0.980 (34.0%)	N.D.

N.D. = not determined.

Results in parentheses represent % reduction from pre-treatment

Table 2: Reduction of plaque biofilm

	Mean \pm S.D. reduction in area of plaque biofilm (%)				
Time (sec)	5	8	11	14	17
Group					
C	-2.4	-1.6	-1.5	-3.0	N.D.
J	37.8 \pm 15.5				
W	13.3 \pm 1.3				N.D.