

## OBTAINING VERIFIABLE KRM OR NVVTA ACCREDITATION

PE-points: 3

### Directions:

- Follow the simple steps to complete your verifiable accreditation.
- Go to [www.waterpikaccreditatie.nl](http://www.waterpikaccreditatie.nl)
- Click on the title of the online course you wish to complete.
- Answers left blank will be graded as incorrect.
- Please fill out the course evaluation portion.
- The post test and course evaluation must be completed electronically.

### Scoring:

In order to receive credit, you must **answer correctly 10 questions out of 15.**

### Results:

You will be notified by e-mail if you have successfully completed the Answer Sheet.

Your results will be despatched by e-mail to KRM or NVVTA within 4 weeks of submission.

## Questions regarding content or applying for credit?

Contact: Judith Holtkuile, by email: [jholtkuile@waterpik.com](mailto:jholtkuile@waterpik.com) or phone: 0031 (0) 35 695 14 43

## General Enquiries?

Contact: Customer Service at 0031 (0) 35 695 14 43

Waterpik®, Waterpik® (stylised), Plaque Seeker®, Pik Pocket®, Nano™ and WaterFlosser® (stylised) are trademarks of Water Pik, Inc.

PN 20024726STD  
FN 20024726STD-F AA



## PE-POINTS REGISTRATION FOR ACCREDITATION AND ANSWER SHEET

### Course #17-1NL: The Water Flosser: An Evolutionary Step in Interdental Care

Name: \_\_\_\_\_

Position: \_\_\_\_\_

Address: \_\_\_\_\_

City: \_\_\_\_\_

Country: \_\_\_\_\_ Postcode: \_\_\_\_\_

Daytime Phone: \_\_\_\_\_ Mobile: \_\_\_\_\_

Email: \_\_\_\_\_

Course Date: \_\_\_\_\_ BIG-number: \_\_\_\_\_

Registration number: \_\_\_\_\_

Membership of  KRM  NVVTA (check the box of your membership)

### Practice Answer Sheet

Please circle the correct answer for each question.

1.	a	b	c	d
2.	a	b	c	d
3.	a	b	c	d
4.	a	b	c	d
5.	a	b	c	d
6.	a	b	c	d
7.	a	b	c	d
8.	a	b	c	d
9.	a	b	c	d
10.	a	b	c	d
11.	a	b	c	d
12.	a	b	c	d
13.	a	b	c	d
14.	a	b	c	d
15.	a	b	c	d

### Course Evaluation

Circle your response: 1 = lowest, 5 = highest

Course objectives were met	1	2	3	4	5
Content was useful	1	2	3	4	5
Questions were relevant	1	2	3	4	5
Rate the course overall	1	2	3	4	5

How did you acquire this course:

Internet  Tradeshow  Handout



**waterpik®**

## **The Water Flosser**

An Evolutionary Step  
in Interdental Care

## Disclosure Statement:

- The content for this self-study course was developed and written by Carol A. Jahn, RDH, MS; a Water Pik, Inc. employee
- Water Pik, Inc. designed and produced this self-study course
- Water Pik, Inc. manufactures and distributes products addressed in this course

## Course Objective:

To provide the learner with a comprehensive review of the research, which will enable the healthcare provider to recommend, educate, and instruct individuals in the use of a Water Flosser.

## Learning Outcomes:

- List the oral health benefits demonstrated by the Water Flosser
- Discuss the effect the Water Flosser has on plaque biofilm and inflammation
- Compare the use of the Water Flosser to string floss
- Distinguish depth of delivery between the Classic Jet Tip and Pik Pocket™ Tip
- Evaluate solutions/agents for use in a Water Flosser
- Understand the benefits of a Water Flosser for individuals with gingivitis, periodontitis, implants, diabetes, orthodontics
- Instruct individuals in the use of the Water Flosser
- Recommend the Water Flosser to appropriate individuals including when to implement the Plaque Seeker™ Tip, Pik Pocket™ Tip, and Orthodontic Tip

## INTRODUCTION

In the early 1960s, dentist Dr Gerald Moyer and his patient John Mattingly, an engineer, worked together to develop a device with which patients could irrigate their mouths at home and improve their oral health. It took multiple attempts until they developed the precise engineering they needed for the device. Dr. Moyer gave one of these first units to a patient who had been experiencing periodontal problems and after six months of use the patient was so happy with the improvements in his mouth that he invested in the company and later went on to become its first president.

Nearly 50 years since its inception, dental professionals still recommend Dr Moyer's product. Over time, this pulsating device has had many names including oral irrigator, dental cleaning system, dental water jet, and now Water Flosser and the evolution of the name corresponds to advancements in product research. 'Oral irrigator' was the initial name and remained popular for some time as many believed that it was the agent and not the device that was responsible for the oral health improvements. As more studies showed positive results with plain water, the name progressed to 'dental water jet'. In the last a five years, emerging evidence demonstrates the device is an easy, effective alternative to string floss; hence the evolution to 'Water Flosser.'

## THE EARLY YEARS: 1964-1979

The first Water Flosser was called the Octopus (Figure 1) and the delivery tip it came with was the Classic Jet Tip (Figure 2). It was introduced to the dental profession in 1962; a time when the non-specific plaque hypothesis was the widely held view.<sup>1</sup> From the outset, the device was hugely popular and research soon emerged that evaluated the product's mechanisms of action, safety, and efficacy.

Figure 1:  
The First Waterpik®  
Water Flosser:  
The Octopus

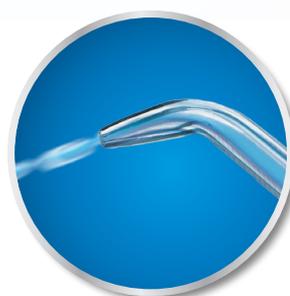


Figure 2:  
The Classic Jet Tip

Some of the first studies were aimed at evaluating the safety of the product's mechanisms of action: pulsation and pressure. The production of 1,200 pulsations per minute was found to be a key component in its effectiveness as this rate was shown to create a compression/decompression phase that expelled debris and bacteria from pockets;<sup>2</sup> three times better than a continuous stream device.<sup>3</sup> In addition to this, a medium to high setting (50 psi-90 psi) was demonstrated to be safe and more effective than a lower setting (Table 1).<sup>2,3,4</sup> During this time, US Army oral surgeons serving in Vietnam were familiar with Dr. Moyer's device and had such confidence in its efficacy that they modified the device to cleanse facial wounds. Orthopedic surgeons soon followed suit using the unit to clean soft tissue and bone.<sup>5,6</sup>

Table 1: Percentage of Debris Removal Based on Pressure Setting.<sup>3</sup>

Setting	Debris removal with tip perpendicular to long axis of the tooth	Debris removal with tip parallel to long axis of the tooth
Low	55%	81%
Medium	93%	95%
High	96%	97%

Because the product was new and very different from traditional self-care products (toothbrushes and string floss) some researchers were concerned about the potential of the device to cause penetration of bacteria into a pocket. In two separate studies tissue was stained with ink and evaluated for penetration of carbon particles. In each study there was some penetration of carbon into the crevicular epithelium but each investigator uncovered enough evidence of mitigating circumstances to question the results. One found that penetration was not influenced by water pressure<sup>7</sup> and the other discovered that non-irrigated areas also had carbon penetration leading to speculation that the knife blade caused particle penetration during the biopsy.<sup>8</sup> Furthermore, the investigator cautioned against drawing definitive conclusions from the study deeming the controversy more academic than practical.<sup>8</sup> Krajewski also biopsied tissue post irrigation and found that which had been irrigated twice daily to have less inflammation, better connective tissue organisation, and an increased thickness in the keratin layer compared to those who did not use a Water Flosser.<sup>9</sup> Similarly, biopsies of the interdental col tissue after one month of Water Flosser use found less inflammation compared to non-users who had an increase in inflammation.<sup>10</sup>

Others evaluated the potential for the development of bacteremia. Studies indicate that the incidence of bacteremia from a Water Flosser is similar to that of other self-care devices and mastication.<sup>11,12,13,14,15</sup> Findings have shown ranges from 7% in people with gingivitis<sup>12</sup> to 50% in those with periodontitis.<sup>13</sup> For people with no history of periodontal disease and no evidence of gingivitis, Berger et al found a 27% rate of bacteremia<sup>14</sup> whereas Tamini et al found no subjects developed a bacteremia after using the device.<sup>15</sup>

One of the first studies to review the efficacy of the Water Flosser was conducted in 1969 by Dr. Ralph Lobene. He found that the Water Flosser used once daily with water reduced gingivitis by 52% compared to 32% for brushing. Subjects using the Water Flosser also had 50% less calculus accumulation.<sup>16</sup> Likewise, a different study found subjects that used the Water Flosser had better periodontal health including less plaque and calculus.<sup>17</sup> Lainson et al studied the long-term effectiveness of the Water Flosser and found that one year after the completion of a three month study, 66% of patients were still using the Water Flosser, and they had a significant reduction in gingivitis compared to the start point. There were no reported harmful effects on hard or soft tissues.<sup>18</sup>

The first study to look at the ability of the Water Flosser to reduce bacteria was conducted on fully banded orthodontic patients. After 63 days of use, toothbrushing and the Water Flosser were 80% more effective than toothbrushing and rinsing in reducing the total aerobic flora and 60% more effective in reducing the lactobacillus count. Even though the investigators did not measure plaque, based on the reduction in lactobacilli, they indicated the results pointed to a reduction in plaque from tooth surfaces and interproximal spaces.<sup>19</sup>

Plaque removal was the main focus of a study by Hugoson, who utilised an ‘experimental gingivitis in man’ methodology to evaluate the Water Flosser both as the sole means of oral hygiene and as an adjunct to toothbrushing. In phase one

over a two week period, he compared no oral hygiene to the use of the Water Flosser only. Both groups had increases in plaque and gingivitis. However, those using the Water Flosser only had less plaque and inflammation especially on proximal surfaces. In the second two week phase, toothbrushing was added to both groups. In this instance, it was determined that toothbrushing removed the majority of the plaque and that any left was ‘resistant’ to removal with the Water Flosser. Interestingly, in spite of the findings, the investigator concluded that the product did not fulfill the requirements of a ‘satisfactory plaque control device’ since it did not prevent plaque accumulation or gingivitis when used like a toothbrush; as the only means of oral hygiene.<sup>20</sup>

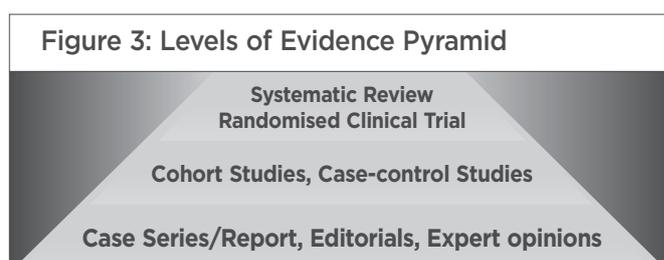
## THE EIGHTIES

While the product was off to a great start in the early years, in the 1980s its ability to remove plaque came under scrutiny; likely influenced by Hugoson’s conclusion.<sup>20</sup> At that time, belief in the non-specific plaque hypothesis was still prevalent and supported by experimental gingivitis study models used by Hugoson.<sup>20</sup> The premise was that accumulated plaque exceeds the host defense system.<sup>1</sup> Today, it is well-established that there are multiple risk factors at play that determine how a patient responds to plaque and the amount of inflammation and disease that occur, and that the Water Flosser is an adjunct to, not a substitute for brushing.<sup>21</sup>

Water flossing devices were dealt an additional blow from a case report that appeared in a 1981 publication called Periodontal Case Reports. In the article, a periodontist wrote a report on a 23 year old female with multiple episodes of rapid bone loss around two first molars and a pre-molar and canine. The patient reported using a ‘water-irrigating’ device aimed at the infected area and the doctor concluded that the device was used improperly and lead to the rapid periodontal destruction.<sup>22</sup>

Today, with the ever-growing knowledge and awareness of what constitutes good scientific evidence, case reports like the one in Periodontal Case Reports,<sup>22</sup> are at the bottom of a pyramid of evidence because case reports are considered weak evidence as there is no verification of the outcome via a control group (**Figure 3**).<sup>21, 23</sup> For example, today, with current knowledge of the different types of periodontal diseases, a 23 year old woman presenting with two seven millimeter pockets around first molars would most likely be diagnosed by culturing bacteria of the type that cause rapidly progressive aggressive periodontal disease.<sup>24</sup>

At the top of the evidence pyramid is the systematic review and randomised clinical trial (RCT). The RCT is ideal for testing



products and new therapies because they build in safeguards such as masking and randomisation to prevent investigator and/or confirmation bias.<sup>23</sup> Today, the RCT is still the gold standard in clinical research.

During the 1980s, as the emphasis began to shift from the non-specific plaque hypothesis to the specific plaque hypothesis, several studies examined the effect of the Water Flosser on subgingival bacteria.<sup>25,26,27</sup> Results from these studies provide evidence to refute the case study's assumption<sup>22</sup> that a Water Flosser drives bacteria into the pocket.<sup>24,25,26</sup> Cobb et al examined a study population of 12 individuals requiring multiple extractions due to advanced chronic periodontal disease. Thirty-two teeth, each with pocket depths of six millimeters and no prior instrumentation for at least six months, were evaluated and half of them were treated with the Water Flosser at 60 psi for eight seconds using only water prior to the extraction. The specimens were treated and examined for bacteria levels by scanning electron microscopy (SEM) and by transmission electron microscopy (TEM) for evidence of epithelial cavitation or ulceration. The investigators found that the Water Flosser reduced the number of microorganisms up to six millimeters. In comparison, the untreated areas had thick mattes of microbes. There were no observable differences between the control and test specimens with regards to the pocket soft tissue wall nor was there evidence of bacterial penetration. They concluded the pulsating Water Flosser effected both a qualitative change on subgingival plaque and is not injurious to soft tissue.<sup>25</sup> Similarly, plaque samples taken from teeth treated with an eight second irrigation with water at 70 psi showed reductions of spirochetes at 3 mm and 6 mm.<sup>26</sup> An antiseptic agent has also demonstrated reductions in microbial counts.<sup>27</sup>

A new area that was explored in 1986 was the depth of penetration into periodontal pockets. Eakle et al tested the Classic Jet Tip at 90 and 45 degree angles and found the 90 degree angle to provide better penetration into the pocket. Depth of penetration varied depending upon pocket depth,

Product	Penetration	Comments
Water Flosser	6 mm <sup>25,26,28,42</sup>	Clinically proven to remove supra and subgingival plaque biofilm and bacteria <sup>25,26,28</sup>
Toothpicks/ Wood Points	Depends on embrasure size	Effectiveness depends on sufficient interdental space
Interdental Brushes	Depends on embrasure size	Effectiveness depends on sufficient interdental space
Floss	3 mm	Cannot access deeper pockets
Rinsing	2 mm <sup>42</sup>	Can reach less accessible areas; minimal subgingival penetration
Tooth-brushing	1-2 mm	No toothbrush, power or manual has demonstrated subgingival access of 6 mm

with the estimated average at about 50%. The data also showed it was possible to achieve 75% depth of penetration in 60% of pockets 7 mm or greater.<sup>28</sup> This study supports the theory that a Water Flosser has the potential to provide greater depth of penetration into pockets than other self-care devices (Table 2).

## THE NINETIES

The specific plaque hypothesis centered on the composition of bacterial plaque and found that when certain microorganisms were present in high numbers, periodontal disease was more likely to occur and this led to the belief that elimination of the pathogen from the pocket would lead to improved health.<sup>1</sup> Soon, non-surgical therapy to improve clinical outcomes began to include various forms of pharmacotherapeutics from those considered 'local delivery agents' to antimicrobials for use as rinses and irrigants.<sup>29</sup> The majority of RCTs conducted on the Water Flosser in the 1990s utilised some type of antimicrobial agent including chlorhexidine,<sup>30-37</sup> essential oil,<sup>38</sup> zinc sulfate,<sup>39</sup> or acetylsalicylic acid<sup>40</sup> as it was believed that these would produce better results than plain water.

An RCT of six months duration compared 0.06% chlorhexidine irrigation, water irrigation, or CHX rinsing (0.12%) to toothbrushing. The results indicated that the best overall results were with 0.06% CHX but found that water irrigation outperformed CHX rinsing in bleeding reductions<sup>41</sup> (Table 3).

Toothbrushing Plus:	Marginal Gingival Bleeding	Bleeding on Probing	Gingival Index
0.06% CHX irrigation	47%	35%	43%
Water Irrigation	40%	24%	23%
CHX rinsing	26%	15%	24%

Another six month RCT found that both 0.04% CHX irrigation, water irrigation, and CHX rinsing all improved oral health but that only the two irrigation groups were able to improve oral health in sites with good existing plaque control and both irrigation media were able to produce microbial changes whereas rinsing could not.<sup>36</sup> Other RCTs using varying dilutions of CHX have had similar findings.<sup>33,34,35,37</sup>

Different agents have had varying degrees of success. For example, essential oil has been shown to reduce plaque, gingivitis, and subgingival pathogens.<sup>38</sup> In a six month RCT of 155 periodontal maintenance patients, water irrigation and irrigation with zinc sulfate were compared to normal oral hygiene. Both water and zinc sulfate were effective at reducing bleeding on probing but water was significantly more effective for gingivitis reduction.<sup>39</sup> When water irrigation was compared to irrigation with acetylsalicylic acid- both were shown to significantly reduced gingivitis, but only water significantly

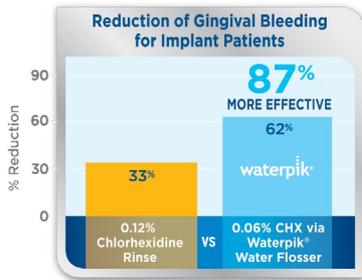


Figure 4: Reduction of gingival bleeding around implants compared to CHX rinsing<sup>37</sup>

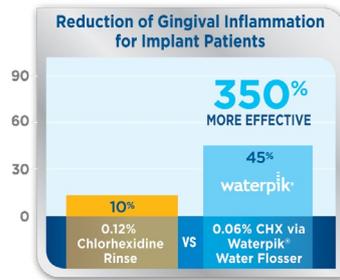


Figure 5: Reduction of gingival inflammation around implants compared to CHX rinsing<sup>37</sup>



Figure 6: Pik Pocket' Tip

reduced bleeding on probing; by 50% over the six month study time frame.<sup>40</sup>

During this decade, RCTs also evaluated the effect of the device on patients with special oral health situations.<sup>37</sup> <sup>41</sup> Felo et al compared 0.06% CHX irrigation to 0.12% CHX rinsing on implants and found that CHX irrigation

reduced bleeding, gingivitis, and calculus formation better than rinsing, with— 62% versus 33% for bleeding and 45% versus 10% for gingivitis<sup>37</sup> (Figures 4 & 5). Burch et al evaluated the Water Flosser with water on adult orthodontic patients and demonstrated significantly better reductions in gingival inflammation and plaque compared to toothbrushing only.<sup>41</sup>

The site specific Pik Pocket™ tip was introduced in 1990 (Figure 6). Investigators found this tip to be able to deliver a solution 90% the depth of a pocket 6 mm or less and 64% the depth of a pocket 7 mm or greater. In comparison, rinsing was shown to penetrate 21% of the depth of the sulcus.<sup>42</sup> RCTs utilising the Pik Pocket' tip have shown it to be safe and effective in reducing bleeding, gingivitis, and periodontal pathogens.<sup>30,37,38</sup>

## THE NEW MILLENNIUM

As the new Millennium began, there was a greater refinement in understanding the etiology of periodontal disease. Two concepts define this era: plaque as biofilm and host inflammatory response. Studies revealed that while disease is initiated by the complex microorganisms present in biofilm, it is the individual's susceptibility and host inflammatory response that lead to the extent and severity of periodontal disease.<sup>43</sup> It was also during this time period that a greater awareness of the need for effective alternatives to string floss began to emerge. A survey from the American Dental Association found that only about one third (32.9%) of people use string floss or other types of mechanical interdental cleaners on a daily basis.<sup>44</sup>

During the 1990s various researchers had hypothesised that the Water Flosser effected a change on host response.<sup>32,36,39</sup> Newman et al noted that it was possible that water

pulsation “might alter the composition of the inflammatory infiltrate.”<sup>39</sup> Chaves et al speculated that a change in the host response might be one way that the Water Flosser achieves improvements in gingival health.<sup>36</sup> Likewise, Flemmig et al suggested that inflammatory reduction may result from a decrease in the toxic products produced by plaque.<sup>32</sup>

In 2000, an RCT was conducted at Baylor University to determine how the Water Flosser impacts the host inflammatory response. For the study, the investigators chose to look at traditional periodontal outcomes (plaque biofilm, gingivitis, bleeding) plus measures of cytokines also called inflammatory mediators.<sup>45</sup> Cytokines were chosen because some, such as interleukin 1β (IL-1β), have been implicated in stimulating osteoclasts to destroy alveolar bone.<sup>46,47</sup> The results found that the Water Flosser reduced the traditional clinical measures of plaque biofilm, bleeding, and gingivitis as well as modulated the cytokine profile. The effect on the inflammatory mediators was considered a modulation versus a reduction because the Water Flosser reduced the pro-inflammatory cytokines, IL-1β and prostaglandin (PGE<sub>2</sub>) but increased the anti-inflammatory mediator interleukin-10 (IL-10), a blocker of IL-1β, and interferon gamma (INFγ), a cytokine key in killing bacteria.<sup>45</sup>

To prevent a dilution effect, the investigators measured the cytokine profile eight hours after subjects used the Water Flosser. They found:<sup>45</sup>

- Even though both routine oral hygiene and routine oral hygiene plus a Water Flosser reduced plaque biofilm, only the group that added the Water Flosser reduced the inflammatory mediator IL-1β
- The reduction of bleeding on probing did not correlate with plaque biofilm reduction but rather the reduction of IL-1β in the Water Flosser group
- The reduction of inflammatory mediators by the Water Flosser was apparently selective suggesting a specific modulation of cytokines

Another RCT conducted at the University of Buffalo measured the serum cytokine profile of subjects. In this study, 52 people with either type 1 or 2 diabetes received scaling and root planning followed by 12 weeks of either routine hygiene or routine hygiene plus the Water Flosser twice daily. Like the study conducted at Baylor, the results showed that the Water Flosser users had better reductions in bleeding, gingivitis, and plaque biofilm plus significant reductions in IL-1β and PGE<sub>2</sub><sup>8</sup> (Figures 7 & 8).

In 2005, the first study that compared the Water Flosser to string floss was conducted at the University of Nebraska. In a 28 day RCT, a Water Flosser was paired with a manual or a power toothbrush and both were compared to a manual toothbrush and string floss. The findings demonstrated that regardless of toothbrush type, the addition of the Water Flosser, once daily with plain water, to either a manual or power brush was an effective alternative to string floss for the reduction of bleeding, gingivitis, and plaque biofilm. It provided superior results in reducing inflammation with the

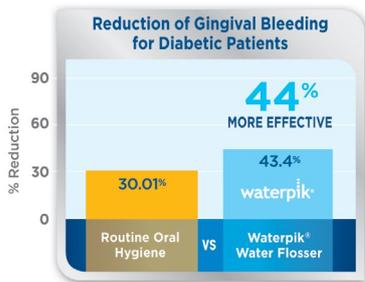


Figure 7: Reduction of gingival bleeding in patients with diabetes<sup>48</sup>

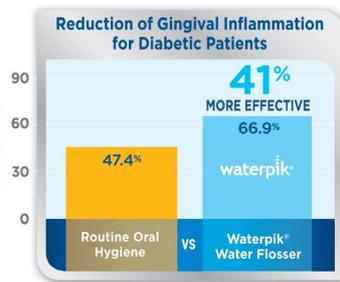


Figure 8: Reduction of gingival inflammation in patients with diabetes<sup>48</sup>

Water Flosser being up to 93% better at reducing bleeding and up to 52% better at reducing gingival inflammation over string floss. Significant improvements in oral health occurred regardless of toothbrush type, so it was deemed likely that many patients currently using a power toothbrush may get further improvements in oral health by the addition of a Water Flosser<sup>49</sup> (Figures 9 & 10).

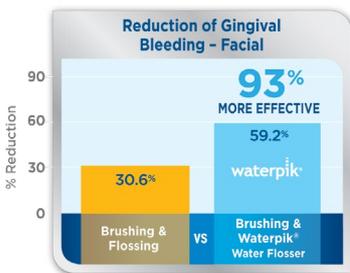


Figure 9: Reduction of gingival bleeding compared to string floss<sup>49</sup>

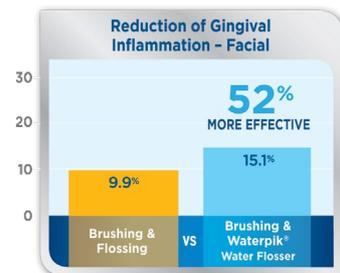


Figure 10: Reduction of gingival inflammation compared to string floss<sup>49</sup>



Figure 11: Orthodontic Tip

The orthodontic tip was introduced in 2007 (Figure 11). The first RCT on this tip evaluated its ability to reduce plaque biofilm and gingivitis on 106 adolescents with fixed orthodontic appliances. Used once daily with water, the orthodontic tip reduced more than three times as much plaque biofilm as manual brushing and flossing with a floss threader and more than five times as much plaque biofilm as brushing alone. Water Flosser users also had an 85% reduction in bleeding from baseline, which was 26% better than string floss and 53% better than toothbrushing alone<sup>50</sup> (Figures 12 & 13).

With recent research consistently showing plaque biofilm removal,<sup>45,48,49,50</sup> a study was undertaken at the University of Southern California Center for Biofilms. The investigators evaluated the effect of a three-second pulsating (1,200 per minute) lavage at medium pressure on plaque biofilm using scanning electron microscopy (SEM). Eight periodontally involved teeth were extracted and ten slices were cut from four teeth, inoculated with saliva and left for four days to further grow plaque biofilm (ex vivo). The results showed that the Water Flosser removed 99.9% and the orthodontic tip 99.8% of biofilm (Figures 14 & 15). The researchers concluded that the hydraulic forces produced by the Water Flosser with 1,200 pulsations at medium pressure can significantly remove plaque biofilm from treated areas of tooth surfaces.<sup>51</sup>

Three comprehensive literature reviews on the Water Flosser were published during this decade.<sup>52-54</sup> In 2005, a report from the Academy of Periodontology noted that the Water Flosser continues to play a role in the treatment of gingivitis and maintenance of periodontal patients. The report states: "the greatest benefit is seen in patients who perform inadequate interproximal cleansing." The paper further highlighted the fact that one of the greatest advantages is that it helps maintain the bacterial reduction achieved during scaling and root planning.<sup>52</sup> A 2006 position paper on floss by the Canadian Dental Hygienists' Association recommends the 'home irrigator' as a one viable option to 'finger flossing'.<sup>53</sup> A systematic review by Hussein et al found that adding a Water Flosser to toothbrushing provided better results in the reduction of bleeding and gingivitis than toothbrushing alone, although no benefit for plaque biofilm reduction above and beyond toothbrushing was shown.<sup>54</sup>

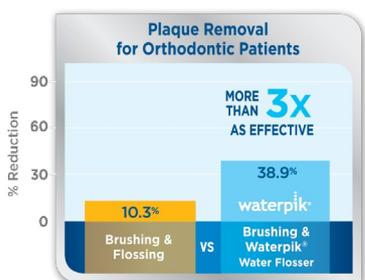


Figure 12: Reduction of plaque versus string floss<sup>50</sup>

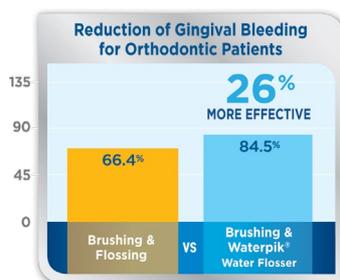


Figure 13: Reduction of gingival inflammation versus string floss<sup>50</sup>

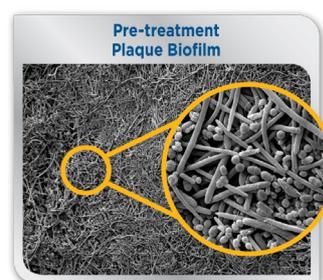


Figure 14: Before treatment with the Water Flosser

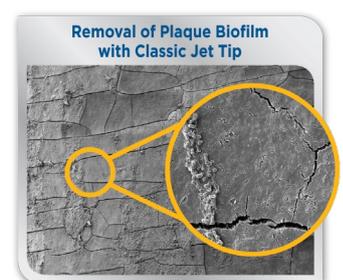


Figure 15: Tooth surface after 3 second use with Water Flosser

## 2010: THE EVOLUTION TO WATER FLOSSER

More people than ever before are living longer and doing so with a functional dentition. Physical limitations such as arthritis, placement of implants, or adult orthodontics can make the use of string floss challenging.<sup>55</sup> Add this to the fact that only about a third of individuals use floss<sup>44</sup> and even less at a level high enough to provide health benefits,<sup>54</sup> leaves dental professionals hungry for easy and effective alternatives they can feel confident recommending.

Evidence for the Water Flosser as an evidence-based alternative to string floss continues to grow. A four-week RCT, conducted at the University of Amsterdam Center For Dentistry found that the Water Flosser and a manual toothbrush were twice as effective as manual brushing and flossing at reducing bleeding (Figure 16). There was no difference in plaque biofilm removal between the tips and dental floss at any point in time.<sup>56</sup>

The Waterpik® Water Flosser has been compared to a novelty device that delivered a teaspoon of water under pressurised air (Sonicare® Air Floss) in a 4-week RCT. The result showed that the Water Flosser was 80% more effective at reducing gingivitis

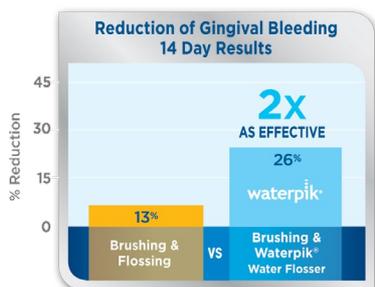


Figure 16: Reduction of gingival bleeding<sup>56</sup>

(Figure 17) and 70% more effective at reducing plaque biofilm (Figure 18). Specifically, the Water Flosser was twice as effective from the lingual surface and three times as effective at the gingival margin as Air Floss in removing plaque.<sup>57</sup>

Using both a sonic toothbrush and a Water Flosser can provide additional benefits over using either a sonic toothbrush or manual toothbrush alone. A 4-week study with 140 subjects found that individuals who used a combination device (Waterpik® Complete Care) (Figure 19) of a Water Flosser and Waterpik® Sonicare® Professional Plus Toothbrush had a 70% better reduction in bleeding and 52% better reduction in plaque removal versus those who used the Sonicare® FlexCare only. In comparison to manual toothbrush, the Complete Care regimen was 159% better at reducing bleeding and 134% better at plaque removal.<sup>58</sup>



Figure 19: Waterpik® Complete Care

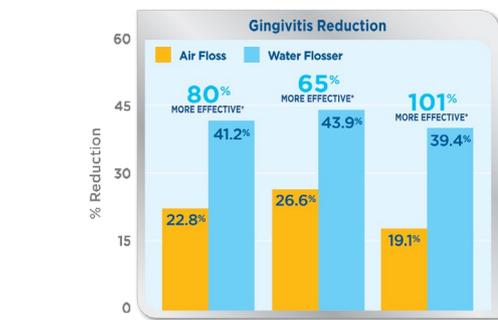


Figure 17: Water Flosser vs. Air Floss: gingivitis reduction<sup>57</sup>

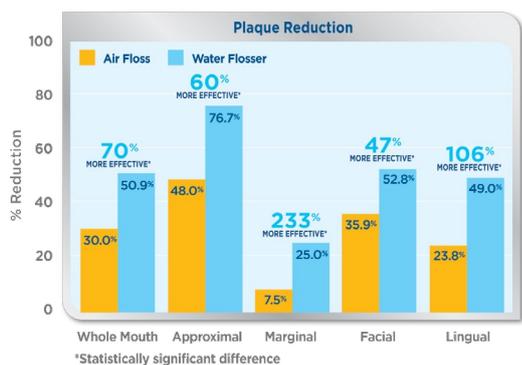


Figure 18: Water Flosser vs. Air Floss: plaque reduction<sup>57</sup>

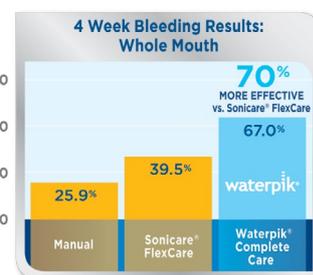


Figure 20: Complete Care chart



Figure 21: Complete Care chart

## USING THE WATERPIK® WATER FLOSSER

Observations show that individuals like and regularly use the Water Flosser.<sup>17,18,32,28,40</sup> Hoover and Robinson noted that subjects stated they felt that using the Water Flosser was a pleasant experience and their mouths felt cleaner.<sup>17</sup> When Lainson et al documented similar comments such as “it stimulate the gums and made the teeth feel cleaner”.<sup>53</sup>

Almost any solution/mouthrinse can be used in a Water Flosser, but when using something other than water, the unit must be flushed by filling the reservoir half full with water, removing the tip, and activating the system. If not, the life of the unit could be shortened.

Three different types of agents have a body of evidence to support their use. They are:

- Water<sup>9,10,16,18,19,25,26,32,36,39,40,41,45,48,49,50,51,57</sup>
- Chlorhexidine<sup>30-37</sup>
- Essential Oils<sup>27,38</sup>

Water is a very effective agent. Some of the benefits of using water are:

- A true “natural” product
- No side effects
- Cost effective
- Readily available

Chlorhexidine (CHX) has frequently been evaluated in Water Flosser studies.<sup>30-37</sup> One of the benefits of using CHX is that, because of better interproximal and subgingival penetration when compared to rinsing, diluting CHX is acceptable for use in a Water Flosser.

Dilutions (based on a 0.12% concentration) that have been shown to be effective via randomized clinical trials are:

- 0.02% = 5 parts water + 1 part CHX<sup>35</sup>
- 0.04% = 3 parts water + 1 part CHX<sup>30,31,36</sup>
- 0.06% = 1 part water + 1 part CHX<sup>32,33,34,37</sup>

Essential oils have also been studied as irrigants.<sup>27,38</sup> An essential oil mouth rinse is readily available over the counter in name brand and generic forms. It is important to note that the effectiveness of essential oil is based on studies using it at full strength only.

## Instructions for Using the Waterpik® Water Flosser

When giving instructions for the use of the Water Flosser, there are some general suggestions that can make learning how to use it a quick and easy process.

- For practical purposes, the unit should not be turned on until the tip is in the mouth.
- Bend from the waist over the sink and hold arm up perpendicular to torso (**Figure 22**).
- Lips should be slightly closed to avoid splashing, but open enough to allow the water to flow freely from the mouth into the sink.
- Before removing the tip from the mouth, pause the flow of water or turn off the unit.
- For comfort, recommend that any solution used is at room temperature.
- Advise individuals to begin at the lowest pressure setting when using the Water Flosser for the first time.

Because there are different types of units available, be sure to review manufacturer’s complete instructions PRIOR to recommending or demonstrating. Recommending and instructing is easier if you have read all instructions and tried the product yourself.



Figure 22: Use of the Water Flosser

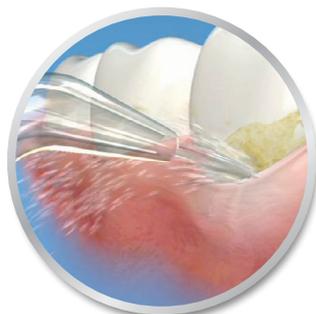


Figure 24: Placement of the Classic Jet Tip



Figure 25: Turn the dial to the lowest setting to use the Pik Pocket® Tip



Figure 26: Placement of the Pik Pocket® Tip

## Tip Selection:

Six different types of tips are available to be used on the Waterpik® Water Flosser allowing for a customized approach depending on individual patient need (**Figure 23**).

	<b>Classic Jet Tip:</b> Good for general cleansing		<b>Orthodontic Tip:</b> Perfect for orthodontic appliances
	<b>Plaque Seeker® Tip:</b> Best for veneers, implants, crowns, and bridges		<b>Tongue Cleaner:</b> For fresher breath
	<b>Pik Pocket® Tip:</b> Ideal for periodontal pockets, furcations, hard to access areas, delivery of medicaments		<b>Toothbrush Tip:</b> For patients who want to brush and water floss simultaneously

### To use the Classic Jet Tip, Plaque Seeker® Tip, Orthodontic Tip, Toothbrush Tip:

- Begin in the molar area and follow a pattern throughout the mouth. This helps avoid missing areas.
- Place the tip between the teeth at a right, 90° angle to the long axis of the tooth at the interproximal space (**Figure 24**).
- After the unit has been turned on and water has begun pulsating, hold the tip in place at the interproximal area for three seconds. This allows adequate penetration of the solution into the gingival crevice or pocket.
- Move the tip around the mouth in a linear fashion following the gingival margin. Make sure that all areas are irrigated from both the buccal and lingual.
- The Orthodontic Tip can also be used around orthodontic brackets.
- With the Toothbrush Tip, brushing action should also be employed. Toothpaste may be used.

The Pik Pocket® tip has been designed for low-pressure delivery, and is latex-free. Since this tip is site specific, individuals will need to know exactly where in the mouth it should be used.

### To use the Pik Pocket<sup>®</sup> Tip:

- Turn the unit to the lowest pressure setting. Failure to do this may shorten the life of the unit (**Figure 25**).
- Gently place the tip just slightly below the gingival margin (**Figure 26**).
- Use a mirror to check that the tip is in the correct place.
- Briefly hold the tip in place before proceeding to another area.

### To use the Tongue Cleaner:

- Turn the unit to the lowest pressure setting
- Place the Tongue Cleaner in the center/midline of the tongue about half way back
- Gently pull the Tongue Cleaner forward
- Repeat several times

## Current Models

There are two basic types of models; countertop and cordless. All have a pulsation rate and pressure range consistent with that needed to achieve clinical outcomes. They will accommodate most types of antimicrobial agents.

The Waterpik<sup>®</sup> Ultra Water Flosser is a countertop model (**Figure 26**). It is the number one choice with dental professionals. This unit is smaller and quieter than previous countertop models. It has ten pressure settings for optimal control. The high volume reservoir provides a water capacity for 90 seconds of cleaning; enough to cleanse the entire mouth. It comes with all six tips.

Another counter top model, the Waterpik<sup>®</sup> Nano™ Water Flosser (**Figure 27**) is compact, quiet, and especially designed to power from the shaver socket. It has three pressure settings and 60 seconds of water capacity. It comes with 2 tips.

The Waterpik<sup>®</sup> Cordless Plus Water Flosser features an advanced ergonomic design with a non-slip grip and dual pressure control system (**Figure 28**). It is lightweight and easy to use. This model runs on a rechargeable battery, has a reservoir with a water capacity for 45 seconds of use, and a week's worth of use should be available from a single charge. It comes with four tips.

The Waterpik<sup>®</sup> Complete Care bundles the proven technology of the Water Flosser with a sonic toothbrush. Like the Ultra, there are 10 pressure settings along with high volume reservoir

that provides for 90 seconds of cleaning. This product comes with 5 tips; two Classic Jet Tips, and one each of the Orthodontic Tip, Plaque Seeker<sup>®</sup> Tip, and Pik Pocket<sup>®</sup> Tip. One standard and one compact toothbrush heads are also included (**Figure 19**).

## Summary:

Since its introduction in 1962, the Waterpik<sup>®</sup> Water Flosser has been evaluated in numerous randomised clinical trials that have demonstrated its safety and efficacy. It is clinically proven to improve oral health through reductions in:

- Plaque biofilm<sup>17,20,41,45,48,49,50,51</sup>
- Bleeding<sup>27,32,35,36,37,38,39,40,41,45,48,49,50,57</sup>
- Gingivitis<sup>16,18,30,32,33,36,37,39,41,45,48,49</sup>
- Periodontal pathogens<sup>19,25,26,27,30,34,36,38</sup>
- Pro-inflammatory mediators/cytokines<sup>45</sup>

The Waterpik<sup>®</sup> Water Flosser has been tested on a wide variety of patients; with most consistent results in those with gingivitis or in periodontal maintenance. It has also been shown to benefit people with unique and/or general health conditions including:

- Orthodontic appliances<sup>19,41,50</sup>
- Implants<sup>37</sup>
- Crown and bridge<sup>9</sup>
- Diabetes<sup>48</sup>

More recently, the Waterpik<sup>®</sup> Water Flosser has been compared to string floss, and three studies have demonstrated that the Water Flosser can reduce plaque, bleeding, and gingivitis as well as string floss.<sup>49,50,57</sup> The studies have evaluated three types of tips, the Classic Jet Tip,<sup>49,57</sup> the Plaque Seeker<sup>®</sup> Tip,<sup>57</sup> and the Orthodontic Tip,<sup>50</sup> and all have been shown to work as well as string floss in removing plaque biofilm and better in reducing bleeding. This makes the Water Flosser an ideal choice for patients who, for whatever reason, do not use floss.

---

*Product Disclaimer:* Most studies referenced in this course have been done using the Waterpik<sup>®</sup> Water Flosser by Water Pik, Inc. While other brands of Water Flossers are available, products are not equivalent when it comes to pressure and pulsations. Therefore, expectations of similar clinical outcomes on products of different brands cannot be assumed.



Figure 27: Waterpik<sup>®</sup> Ultra Water Flosser, Model WP-100; comes with the Classic Jet Tip, Plaque Seeker<sup>®</sup> Tip, Pik Pocket<sup>®</sup> Tip, Orthodontic Tip, Tongue Cleaner, and Toothbrush Tip



Figure 28: Waterpik<sup>®</sup> Nano™ Water Flosser, Model WP-250; comes with the Classic Jet Tip and Plaque Seeker<sup>®</sup> Tip



Figure 29: Waterpik<sup>®</sup> Cordless Plus Water Flosser, Model WP-450; comes with the Classic Jet Tip, Plaque Seeker<sup>®</sup> Tip, Orthodontic Tip, and Tongue Cleaner

## References

- Zambon JJ. Periodontal diseases. Microbial factors. *Ann Periodontol* 1996; 1:879-925.
- Bashkar S et al. Water jet devices in dental practice. *J Periodontol* 1971; 42:658-664.
- Selting WJ et al. Water jet direction and periodontal pocket debridement. *J Periodontol* 1972; 43:569-572.
- Bashkar S et al. Effect of high pressure water jet on oral mucosa of varied density. *J Periodontol* 1969; 40:593-598.
- Keblish DJ, DDeMaio M. Early palatal lavage for the decontamination of combat wounds: Historical review and point proposal. *Mil Med* 1998; 165:844-846.
- Leutze-Hoffmann KA, Schafer DS. Pulsed lavage in wound cleansing. *Phys Ther* 2000; 80:292-300.
- O'Leary TJ et al. Possible penetration of crevicular tissue from oral hygiene procedures. I: Use of oral irrigating devices. *J Periodontol* 1970; 41:158-162.
- Manhold JH et al. Carbon penetration of gingival tissue by oral irrigating devices. *J Prev Dent* 1978; 5:3-6.
- Krajewski J et al. Evaluation of a water pressure cleaning device as an adjunct to periodontal treatment. *J Amer Soc Periodont* 1964; 2:76-78.
- Cantor MT, Stahl SS. Interdental col tissue responses to the use of a water pressure cleansing device. *J Periodontol* 1969; 40:282-295.
- Wank HA et al. Quantitative measurement of bacteremia and its relationship to plaque control. *J Periodontol*, 1976; 47:683-686.
- Roman AR, App GR. Bacteremia, a result from oral irrigation in subjects with gingivitis. *J Periodontol* 1971; 42:757-760.
- Felix JE et al. Detection of bacteremia after the use of an oral irrigation device in subjects with periodontitis. *J Periodontol* 1971; 42:785-787.
- Berger SA et al. Bacteremia after the use of an oral irrigation device. *Annals of Int Med*, 1974; 80:510-511.
- Tamimi GA et al. Bacteremia study using a water irrigation device. *J Periodontol* 1969; 40:4-6.
- Lobene R. The effect of a pulsed water pressure cleansing device on oral health. *J Periodontol* 1969; 40:51-54.
- Hoover DR, Robinson HBG. The comparative effectiveness of a pulsating oral irrigator as an adjunct in maintaining oral health. *J Periodontol* 1971; 42:37-39.
- Lainson PA et al. A longitudinal study of pulsating water pressure cleansing devices. *J Periodontol* 1972; 43:444-446.
- Hurst JE, Madonia JV. The effect of an oral irrigating device on the oral hygiene of orthodontic patients. *J Am Dent Assoc* 1970; 81:678-682.
- Hugoson A. Effect of the Water Pik® device on plaque accumulation and the development of gingivitis. *J Clin Periodontol* 1978; 5:95-104.
- Nunn ME. Understanding the etiology of periodontitis: an overview of periodontal risk factors. *Periodontology* 2000 2003; 32:11-23.
- Winter A. Rapid destruction caused by a water-irrigating device. *Periodontal Case Reports* 1981; 3:11-14.
- Forrest J et al. Introduction to evidence-based decision making. In M Newman, H Takei, P Klokkevold, F Carranza (Eds.) *Clinical Periodontology*, 10th ed. 2006. St Louis: Saunders Elsevier.
- Novak KF, Novak MJ. Aggressive periodontitis. In M Newman, H Takei, P Klokkevold, F Carranza (Eds.) *Clinical Periodontology*, 10th ed. 2006. St Louis: Saunders Elsevier.
- Cobb CM et al. Ultrastructural examination of human periodontal pockets following the use of an oral irrigation device in vivo. *J Periodontol* 1988; 59:155-163.
- Drisko C et al. Comparison of dark-field microscopy and a flagella stain for monitoring the effect of a Water Pik on bacterial motility. *J Periodontol* 1987; 58:381-386.
- Ciancio SG et al. Effect of a chemotherapeutic agent delivered by an oral irrigation device on plaque, gingivitis, and subgingival microflora. *J Periodontol* 1989;60:310-315.
- Eakle S et al. Depth of penetration into periodontal pockets with oral irrigation. *J Clin Periodontol* 1986; 13:39-44.
- Drisko CH. Non-surgical pocket therapy. Pharmacotherapeutics. *Ann Periodontol* 1996; 1:491-566.
- Jolkovsky DL et al. Clinical and microbial effects of subgingival and gingival marginal irrigation with chlorhexidine gluconate. *J Periodontol* 1990; 61:663-669.
- Waki MY et al. Effects of subgingival irrigation on bacteremia following scaling and root planning. *J Periodontol* 1990; 61:405-411.
- Flemmig TF et al. Supragingival irrigation with 0.06% chlorhexidine in naturally occurring gingivitis. I. 6 month clinical observations. *J Periodontol* 1990; 61:112-117.
- Brownstein CN et al. Irrigation with chlorhexidine to resolve naturally occurring gingivitis: a methodologic study. *J Clin Periodontol* 1990; 17:588-593.
- Newman MG et al. Irrigation with 0.06% chlorhexidine in naturally occurring gingivitis. II: 6 months microbiological observations. *J Periodontol* 1990; 61:427-433.
- Walsh TF et al. Clinical effects of pulsed oral irrigation with 0.2% chlorhexidine digluconate in patients with adult periodontitis. *J Clin Periodontol* 1992; 19:245-248.
- Chaves ES et al. Mechanism of irrigation effects on gingivitis. *J Periodontol* 1994; 65: 1016-1021.
- Felo A et al. Effects of subgingival chlorhexidine irrigation on peri-implant maintenance. *Am J Dent* 1997; 10:107-110.
- Fine JB et al. Short-term microbiological and clinical effects of subgingival irrigation with an antimicrobial mouthrinse. *J Periodontol* 1994; 65:30-36.
- Newman MG et al. Effectiveness of adjunctive irrigation in early periodontitis: Multi-center evaluation. *J Periodontol* 1994; 65:224-229.
- Flemmig TF et al. Adjunctive supragingival irrigation with acetylsalicylic acid in periodontal supportive therapy. *J Clin Periodontol* 1995; 22:427-433.
- Burch JG et al. A two-month study of the effects of oral irrigation and automatic toothbrush use in an adult orthodontic population. *Am J Orthod Dentofac Orthop* 1994; 106:121-126.
- Braun RE, Ciancio SG. Subgingival delivery by an oral irrigation device. *J Periodontol* 1992; 63:469-472.
- Kinane DF, Bartold PM. Clinical relevance of the host responses of periodontitis. *Periodontology* 2000 2007; 43:278-293.
- Just the Facts, Flossing. Survey Center. *ADA News*. Nov. 2007
- Cutler CW et al. Clinical benefits of oral irrigation for periodontitis are related to reduction of pro-inflammatory cytokine levels and plaque. *J Clin Periodontol* 2000; 27:134-143.
- Gemmel E et al. Cytokines and prostaglandins in immune homeostasis and tissue destruction in periodontal disease. *Periodontology* 2000 1997; 14:112-143.
- Offenbacher S. Periodontal diseases: Pathogenesis. *Ann Periodontol* 1996; 1:821-878.
- Al-Mubarak S et al. Comparative evaluation of adjunctive oral irrigation in diabetes. *J Clin Periodontol* 2002; 29:295-300.
- Barnes CM et al. Comparison of irrigation to floss as an adjunct to toothbrushing: Effect on bleeding, gingivitis, and supragingival plaque. *J Clin Dent* 2005; 16:71-77.
- Sharma NC et al. Effect of a dental water jet with orthodontic tip on plaque and bleeding in adolescent patients with fixed orthodontic appliances. *Am J Orthod Dentofacial Orthop* 2008; 133:565-571.
- Gorur A et al. Biofilm removal with a dental water jet. *Compend Contin Educ Dent* 2009; 30 (Suppl 1):1-6.
- Greenstein G. Research, Science, and Therapy Committee of the American Academy of Periodontology. Position paper: The role of supra- and subgingival irrigation in the treatment of periodontal diseases. *J Periodontol* 2005; 76:2015-2027.
- Assadorian J. Canadian Dental Hygienists' Association Position Statement: Flossing. *CJDH* 2006; 40:1-10.
- Husseini A et al. The efficacy of oral irrigation in addition to a toothbrush on plaque and the clinical parameters of periodontal inflammation: A systematic review. *Int J Dent Hygiene* 2008; 6:304-314.
- Rosema NAM et al. The effect of different interdental cleaning devices on gingival bleeding. *J Int Acad Periodontol* 2011; 13(1):2-10.

## POST TEST COURSE #17-1NL

### The Water Flosser: An Evolutionary Step in Interdental Care

- 1. Which statement is true?**
  - a. Pulsation is 3 times more effective than a steady or continuous stream.
  - b. Pulsation creates a compression and decompression phase.
  - c. A rate of 1,200 pulsations is key to effectiveness
  - d. All of the above
- 2. The ideal pressure setting range is:**
  - a. Low only
  - b. Low to medium
  - c. Medium to high
  - d. High only
- 3. Which individuals with special needs have been shown to benefit from a Water Flosser?**
  - a. People with implants
  - b. People with orthodontic appliances
  - c. People with diabetes
  - d. All of the above
- 4. Average estimated depth of delivery into the sulcus using the Classic Jet tip at a 90 degree angle is:**
  - a. 10%
  - b. 25%
  - c. 50%
  - d. 100%
- 5. Which statement is true regarding the Pik Pocket' subgingival irrigation tip?**
  - a. In pockets < 6 mm it reaches 52%; pockets > 7 mm it reaches 99%
  - b. In pockets < 6 mm it reaches 90%; pockets > 7 mm it reaches 64%
  - c. In pockets < 6 mm it reaches 52%; pockets > 7 mm it reaches 28%
  - d. In pockets < 6 mm it reaches 76%; pockets > 7 mm it reaches 42%
- 6. Which agents are the only ones with a body of scientific evidence to show they are effective when used with a Water Flosser?**
  - a. Chlorhexidine, Essential Oil, Water
  - b. Chlorhexidine, Sodium Chlorite, Povidone Iodine
  - c. Chlorhexidine, Essential Oil, Povidone Iodine
  - d. Chlorhexidine, Sodium Chlorite, Water
- 7. The Waterpik' Water Flosser has been shown to reduce pathogenic bacteria up to:**
  - a. 2 mm
  - b. 4 mm
  - c. 6 mm
  - d. 8 mm
- 8. Which tip has been used in the Water Flosser comparisons to string floss?**
  - a. Classic Jet Tip
  - b. Plaque Seeker' Tip
  - c. Orthodontic Tip
  - d. All of the above
- 9. When compared to string floss, the Water Flosser has been shown to be twice as effective at reducing bleeding AND as effective at reducing plaque biofilm.**
  - a. The first statement is true, the second statement is false.
  - b. The first statement is false; the second statement is true.
  - c. Both statements are true.
  - d. Both statements are false.
- 10. The site specific Pik Pocket' Tip is recommended for:**
  - a. Furcations
  - b. Deep pockets
  - c. Difficult to access areas
  - d. All of the above
- 11. The incidence of bacteremia from a Water Flosser ranges from 0-50%; the rate is similar to other self-care devices.**
  - a. Both statements are true.
  - b. Both statements are false.
  - c. The first statement is true; the second statement is false.
  - d. The first statement is false; the second statement is true.
- 12. The Water Flosser has been demonstrated to reduce:**
  - a. Plaque biofilm
  - b. Bleeding and gingivitis
  - c. Periodontal pathogens and inflammatory mediators
  - d. All of the above
- 13. The use of the Water Flosser on people with implants:**
  - a. Reduced bleeding
  - b. Reduced gingivitis
  - c. Reduced calculus
  - d. All of the above
- 14. The use of a Water Flosser twice daily on people with diabetes:**
  - a. Had no effect at all on oral health
  - b. Reduced calculus only
  - c. Reduced bleeding, gingivitis, plaque, IL-1 $\beta$ , and PGE $_2$
  - d. Improved blood sugar readings
- 15. The Plaque Seeker' Tip is best for:**
  - a. Veneer
  - b. Implants
  - c. Crowns
  - d. All of the above