



**waterpik®**

# **THE WATER FLOSSER: YOUR TOOL FOR OPTIMAL HEALTH**

## DISCLOSURE STATEMENT

- The content for this self-study course was written by Carol A. Jahn, RDH, MS, an employee of Water Pik, Inc., a subsidiary of Church & Dwight Co., Inc.
- This course was designed, developed, and produced by Water Pik, Inc.
- Water Pik, Inc manufactures and distributes products addressed in this course.

## COURSE OBJECTIVE

To provide the learner with a comprehensive scientific review of the efficacy and safety of the Water Flosser, which will enable dental professionals to recommend, educate, and instruct individuals regarding 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
- 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

The Water Flosser, like many successful products, was born from both failure and persistence. Dr. Gerald Moyer, a Fort Collins, Colorado, dentist, wanted a water irrigation device to help his patients with periodontal disease. He collaborated with his friend and patient, John Mattingly, a hydraulics engineer at Colorado State University. The two worked together on the device every evening. It was not until their 146th attempt that they developed the precise engineering needed for the product.

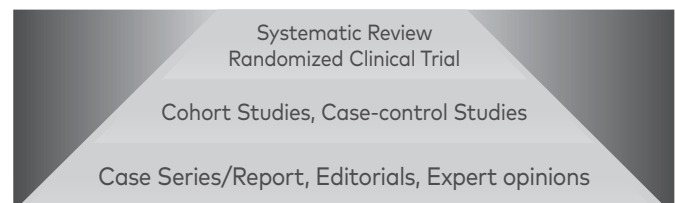
The first Water Flossers were handmade by John Mattingly (Figure 1). Dr. Moyer gave one of these devices to a patient who had periodontal problems. The patient used it religiously for 6 months and was so happy with the improvements in his mouth that he invested in the company and later went on to be its first president. He was so confident in the Water Flosser that he convinced more than 20 other Fort Collins business leaders, many of whom were dentists, to invest in the product. The first place these original board members chose to sell the product was a dental convention.

Figure 1:  
The first water flosser  
called the Octopus



More than 50 years since its inception, the Water Flosser is backed by over 70 research studies that consistently demonstrate its safety and effectiveness.<sup>1,2</sup> With today's focus on scientific evidence as the benchmark, long-ago anecdotal stories and personal case reports on the water flosser have been exposed as unreliable opinions. Systematic reviews and randomized clinical trials (RCT) are the gold standard in clinical research

Figure 2: Levels of Evidence Pyramid



(Figure 2). RCTs provide built-in safeguards such as blinding and randomization to prevent investigator or confirmation bias. A systematic review focuses on a single research question and reviews multiple RCTs to determine which products, therapies, and other interventions provide the best outcomes. In comparison, personal case reports are considered weak evidence because there is no verification of the outcome via a control group, blinding, or other safeguards.

More dental professionals than ever recommend the Water Flosser to people who will not floss, have orthodontic appliances, implants, crowns, bridges, and gingivitis, or are in periodontal maintenance.<sup>3</sup> Studies support the use of the Water Flosser for these clinical indications.<sup>1</sup> The Water Flosser has been clinically proven to reduce numerous clinical parameters including calculus, plaque/biofilm, gingivitis, bleeding, periodontal pathogens, probing depth, and inflammatory mediators.<sup>1</sup>

## HOW IT WORKS: ACTION AND DEPTH OF DELIVERY

The critical action of the Water Flosser is its unique combination of pulsation and pressure. They create a compression and decompression phase that can remove plaque biofilm and disrupt bacteria. Compared to a steady stream, a pulsating device has

been shown to be three times as effective at removing debris.<sup>4</sup> Conventional wisdom says that water cannot remove plaque and that mechanical action is required. Pulsating water under pressure is different from simple swishing because the combination of pulsation and pressure produces sheer hydraulic forces that are capable of removing plaque biofilm.<sup>5</sup>

[Click here to see a video of a water flosser removing plaque biofilm.](#)



Figure 3: Standard Jet Tip/Classic Jet Tip

Another outcome from pulsation and pressure is hydrokinetic activity, which provides for subgingival penetration into the sulcus or pocket. Studies evaluating a standard jet tip (Figure 3) have found that it allows the solution to penetrate, on average, approximately 50% of the depth of the pocket.<sup>6</sup> Investigators also found that depth of penetration was better with the tip placed at a 90° angle to the tooth versus a

45° angle<sup>6</sup> (Table 1). Others have looked at disruption of bacteria. Cobb et al. and Drisko et al. both found that water flossing with a standard jet tip can reduce periodontal pathogens up to 6 millimeters.<sup>7,8</sup>

Tip Placement	90 degree angle		45 degree angle	
Pocket Depth	Mean Percent Penetration	Incidence of 75% Penetration	Mean Percent Penetration	Incidence of 75% Penetration
0-3 mm	71%	43%	54%	31%
4-7 mm	44%	25%	46%	30%
7 mm	68%	60%	58%	34%

\*Adapted from Jahn<sup>1</sup>

[Click here to view the depth of penetration from a standard jet tip](#)

The use of a soft, rubber, site-specific tip (Figure 4) provides localized delivery to an individual site such as a deep pocket,



Figure 4: Site specific tip/Pik Pocket™ Tip

furcation, implant, crown, and bridge. This type of tip should be used as an adjunct to a jet tip, implant tip, or orthodontic tip. It has been demonstrated via a clinical trial to deliver a solution into the pocket up to 90% of its depth in pockets 6 mm or less. For pockets 7 mm or greater, depth of penetration is 64%.<sup>9</sup>

[Click here to view the depth of penetration from a site specific tip.](#)

Evidence indicates that the Water Flosser has the greatest potential of any self-care device for subgingival access into the

Product	Penetration	Comments
Water Flosser	6 mm <sup>7,8</sup>	Penetration has been shown to reach up to 68% in deep pockets <sup>6</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>9</sup>	Can reach less accessible areas; minimal subgingival penetration
Toothbrushing	1–2 mm	No toothbrush, power or manual, has demonstrated subgingival access of 6 mm

periodontal pocket<sup>6-10</sup> (Table 2). Studies documenting subgingival access in vivo for tooth brushing and flossing are limited. Conventional wisdom rather than scientific evidence says that tooth brushing typically reaches 1–2 millimeters and traditional dental floss up to 3 millimeters. The ability of a sonic toothbrush to have an effect on bacteria subgingivally has been tested only in the laboratory setting and has not been proven definitively in vivo.<sup>11,12,13</sup> A clinical trial by Williams et al. compared the disruption of plaque and bacteria from a sonic and a manual toothbrush after 15 seconds of brushing time and found both removed plaque and microbes up to 1 mm.<sup>14</sup>

## WHAT IT DOES: REDUCTION OF CLINICAL PARAMETERS

One of the first clinical studies on water flossing was published in the *Journal of Periodontology* in 1969.<sup>15</sup> Since that time more than 70 additional studies have been conducted at university- and research-based facilities by experienced investigators and published in peer-reviewed journals. These studies have evaluated clinical parameters such as calculus, plaque/biofilm, gingivitis, bleeding, periodontal pathogens, probing depth, and inflammatory cytokines.<sup>1</sup>

**Calculus.** One of the earliest studies on water flossing looked at calculus reduction and found that adding a Water Flosser to tooth brushing reduced calculus by 50%.<sup>15</sup> Others have found similar findings.<sup>16,17</sup> Water flosser devices that promote the benefits of magnetic polarity have been endorsed as tools for enhancing calculus reduction. In two separate clinical trials, a unit with magnetic polarity was compared to a unit of the same brand minus the magnet. The unit with the magnet was shown, via a novel index that combined calculus and plaque, to provide a greater calculus reduction on lower anterior teeth.<sup>18,19</sup> However, this enhanced calculus reduction did not result in greater improvements in oral health because gingivitis reductions between the magnetized and non-magnetized unit were similar. In addition,

the index used to measure plaque and calculus was new and had not, and has not yet, been validated.

**Plaque biofilm.** For many years, it was widely believed that water flossing could not remove plaque biofilm. Studies from the 1990s conducted on periodontal maintenance patients often reported minimal or no increased reduction of supragingival plaque biofilm with water flossing, yet significant improvements in bleeding or gingivitis were shown.<sup>15, 20-25</sup> Several investigators hypothesized that the effect might be due to changes in the subgingival biofilm composition including an alteration in key pathogens.<sup>20, 22, 24, 25</sup>



Figure 5: Before treatment with the water flosser, Gorur et al.<sup>5</sup>

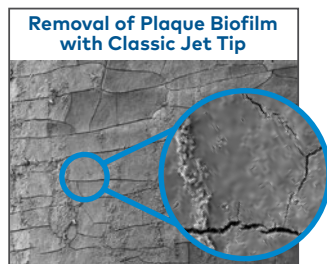


Figure 6: Tooth surface after a 3-second treatment with the Water Flosser, Gorur et al.<sup>5</sup>

More recent studies resulted in different findings. Eleven studies conducted since 2000 have reported positive findings regarding water flossing and plaque biofilm removal.<sup>5,26-35</sup> A study conducted at the University of Southern California Center for Biofilms evaluated the effect of shear hydraulic forces from water flossing on plaque biofilm using scanning electron microscopy (SEM).<sup>5</sup> Eight teeth were extracted from a patient with advanced periodontal disease. Pretreatment SEM images of the teeth found they were colonized by a luxuriant biofilm appearing several micrometers thick (**Figure 5**). The teeth were water flossed for 3 seconds at a medium pressure (70psi) setting. Post-SEM images found that water flossing removed up to 99.9% of plaque biofilm<sup>5</sup> (**Figure 6**). The researchers concluded that the shear hydraulic forces produced by a water flosser with 1,200 pulsations per minute at medium pressure can significantly remove biofilm from tooth surfaces.<sup>5</sup>

The plaque biofilm removing capabilities of the Water Flosser were further evaluated in a single-use study. Seventy adults abstained from all oral hygiene for 23–25 hours. The subjects rinsed with a red disclosing solution then used a manual toothbrush and a Water Flosser or a manual toothbrush and dental floss. Standard brushing and flossing instructions were provided as were directions for using the Water Flosser. The investigators found that the Water Flosser group removed 74% of whole mouth plaque compared to 56% for string floss, making the Water Flosser 29% more effective.<sup>34</sup> The Water Flosser also removed nearly 82% of approximal plaque compared to 63% for string floss<sup>34</sup> (**Figure 7**). These findings are supported by Sharma et al., who found the Water Flosser removed 75% of whole mouth plaque and 83% of approximal plaque.<sup>32</sup>

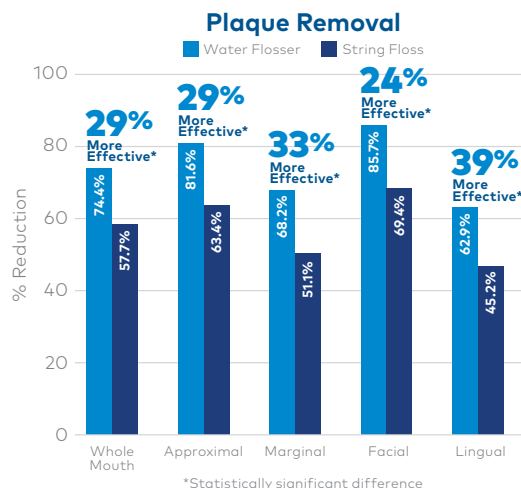


Figure 7: Plaque Removal: Water Flosser versus string floss, Goyal et al.<sup>34</sup> (single use)

**Gingivitis and bleeding.** While bacterial plaque biofilm is an essential precursor to gingivitis and periodontal disease, today it is widely established that each individual may respond differently to plaque biofilm, leading to broad differences in the extent and severity of disease among patients. It has been demonstrated that some people are over-responders to plaque biofilm, while others may have profuse plaque and never progress beyond gingivitis.<sup>36</sup> Because of this, reduction in bleeding is viewed as a more significant marker of health than plaque biofilm reduction.

Several studies have shown that the Water Flosser is extremely effective in reducing gingivitis and bleeding.<sup>15-17, 20-29, 30-33, 35, 37-43</sup> In a University of Nebraska study, the Water Flosser was paired with a manual or a power toothbrush, and both were compared to traditional manual brushing and flossing to see which routine was the most effective. Regardless of toothbrush type, the addition of a Water Flosser, once daily with plain water, to a either a manual or power brushing routine was a more effective alternative to string floss for the reduction of bleeding, gingivitis, and plaque. Notably, the Water Flosser was up to 93% better at reducing bleeding and up to 52% better at reducing gingivitis over manual flossing. Significant improvements in oral health occurred regardless of toothbrush type, so it is likely that many patients currently using a power toothbrush may get further improvements in oral health by the addition of a Water Flosser.<sup>28</sup> Likewise, Goyal et al. found that people who used a power toothbrush and Water Flosser had significantly better bleeding and gingivitis reductions than those who used either a power (70%, 48% respectively) or manual toothbrush (159%, 134% respectively).<sup>33</sup>

**Infection and inflammation.** The Water Flosser has been shown to reduce the pathogens responsible for initiation of the periodontal infection<sup>7, 8, 22, 23, 37, 38, 43</sup> as well as the inflammatory mediators responsible for attachment and bone loss.<sup>26, 27</sup> Cobb et al. and Drisko et al. demonstrated that a Water Flosser with water reduced bacteria up to 6 millimeters.<sup>7, 8</sup> Likewise, Chaves et al.

found the Water Flosser with either water or diluted chlorhexidine (CHX) reduced subgingival pathogens. In comparison, they found rinsing with full-strength CHX did not achieve the same results.<sup>22</sup>

The site-specific delivery tip also has been shown to be effective at reducing subgingival pathogens.<sup>37,38</sup> Jolkovsky et al. and Fine et al. used the site-specific tip to deliver an antimicrobial agent and found reduced inflammation and a decrease in pathogens.<sup>37</sup> <sup>38</sup> This tip is a good choice for individuals who have areas that are challenging to manage periodontally or have areas difficult to access such as a deep pocket, furcation, implant, crown, or bridge.

After years of speculation by researchers regarding the effect of water flossing on the immune system response, researchers at Baylor University evaluated how the Water Flosser affects the host inflammatory response.<sup>26</sup> Cutler et al. looked at traditional periodontal outcomes plus measures of cytokines, also called inflammatory mediators.<sup>26</sup> Cytokines were chosen because some, such as IL-1 $\beta$ , have been implicated in stimulating osteoclasts to destroy alveolar bone.<sup>44,45</sup> The investigators discovered that water flossing reduced crevicular cytokine levels, most notably IL-1 $\beta$ , thus potentially inhibiting periodontal disease activity. It is important to note that measures of the cytokines were taken 8 hours after use of the Water Flosser so that any dilution effect would be eliminated.<sup>26</sup> A University of Buffalo study also found that water flossing reduced the production of serum IL-1 $\beta$ .<sup>27</sup>

**Probing depth.** Some investigators have looked at the effect of the Water Flosser on probing depth reduction. Most have demonstrated small yet statistically significant reductions generally ranging from 0.1 millimeters to 0.4 mm.<sup>20, 21, 23, 25, 26, 37, 39, 40, 42</sup> The clinical significance of this finding lends support to the safety of the Water Flosser as well as its potential for helping periodontal maintenance patients maintain stability.

## WHO BENEFITS FROM USING A WATER FLOSSER

The Water Flosser has long been a mandatory device for people in orthodontic treatment<sup>29, 40</sup> and periodontal maintenance.<sup>20-27, 37-39, 42</sup> More recently, the Water Flosser has emerged as one of the few self-care tools that has been tested on people with implants and found safe and effective for daily use.<sup>16, 42</sup> However, the largest

group to date that has been shown to benefit from a water flosser are those who cannot, will not, or simply do not floss.<sup>28-35</sup>

**Orthodontic appliances** present significant cleaning challenges for patients of any age. A study of 106 adolescents 11–17 years of age compared manual tooth brushing plus a Water Flosser with a tip designed specifically for orthodontic



Figure 8: Orthodontic Tip

appliances (**Figure 8**) to two other groups: manual tooth brushing plus flossing via a floss threader versus manual tooth brushing alone. The results showed that the addition of the Water Flosser to tooth brushing reduced 3.76 times more plaque than flossing with a floss threader and 5.83 times more plaque than manual tooth brushing alone. The Water Flosser also provided a significantly better reduction in bleeding: 84.5% from baseline. This was 26% better than the results achieved with dental floss, and 53% better than brushing alone.<sup>29</sup> (**Figures 9, 10**). These results are in line with a study on adult orthodontic patients that found, regardless of whether a manual or power toothbrush were used, adding a Water Flosser provided significantly better reductions in bleeding and inflammation.<sup>40</sup>

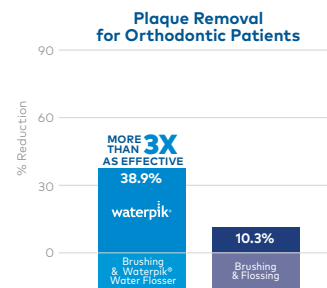


Figure 9: Reduction of plaque versus string floss, Sharma et al.<sup>29</sup>

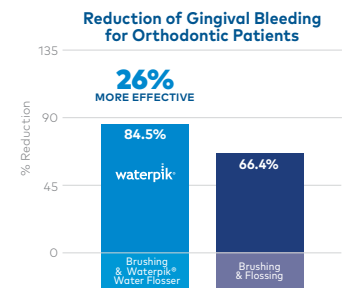


Figure 10: Reduction of gingival bleeding versus string floss, Sharma et al.<sup>29</sup>

[Click here to see the use of the orthodontic tip](#)

**Periodontal maintenance.** Statistics indicate that nearly half of U.S. adults aged 30 and older have periodontitis.<sup>46</sup> This fact suggests that helping people prevent and arrest periodontal disease is a top concern for most dental practices. The Water Flosser has a well-established body of evidence for improving oral health in periodontal maintenance patients.<sup>20-27, 37-39, 42</sup> A recent study by Genovesi et al. evaluated the difference between scaling and root planing (SRP) followed by the local delivery of minocycline or SRP followed by daily water flossing for 30 days. The results demonstrated that both treatments effectively reduced bleeding on probing and improved pocket depth and clinical attachment at 30 days<sup>42</sup> (**Figures 11, 12, 13**). There were no statistical differences between the groups, thus showing that the Water Flosser is an effective alternative to subgingival antibiotics for periodontal maintenance patients over a 30-day period.<sup>42</sup>

Several 6-month studies were conducted during the 1990s on periodontal maintenance patients.<sup>20, 21, 22, 25</sup> Findings from these studies consistently showed that the Water Flosser improved the oral health of this demographic. Notably, water flossing is extremely effective at reducing bleeding upon probing (BOP). Flemmig et al. found that water flossing reduced BOP by half over the 6-month time frame,<sup>21</sup> and Newman et al. showed that those with the most BOP had the greatest reductions.<sup>20</sup> In a different study, Flemmig et al. found that water flossing was

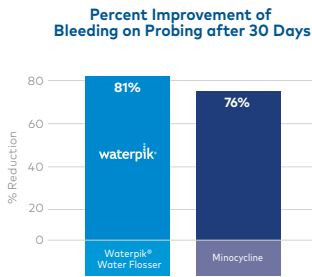


Figure 11: BOP reductions in periodontal maintenance patient, Genovesi et al.<sup>42</sup>

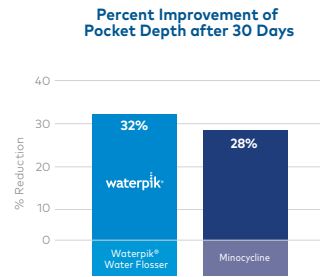


Figure 12: Probing depth improvements in periodontal maintenance patients, Genovesi et al.<sup>42</sup>

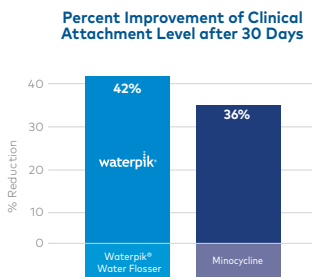


Figure 13: CAL improvement in periodontal maintenance patients, Genovesi et al.<sup>42</sup>

more effective than rinsing with 0.12% chlorhexidine at reducing BOP.<sup>25</sup>

**Diabetes** has been shown to increase the risk for developing periodontal disease. A study at the University of Buffalo looked at how the Water Flosser benefited the periodontal health of people with diabetes. The results found that the addition of the Water Flosser to routine oral hygiene was more effective at reducing bleeding (44%) and gingival inflammation (41%) than routine oral hygiene alone. Plaque and gingivitis were also significantly reduced as well as the inflammatory mediators, IL-1 $\beta$  and PGE $_2$ .<sup>27</sup>

**Implants** have become the favored choice for single-tooth replacement. They are also vulnerable to both mucositis and peri-implantitis.<sup>47</sup> Typically, traditional brushing and flossing have been the recommended self-care strategy. Recently, an observational study at the Academic Centre for Dentistry Amsterdam reported on 10 patients with progressive peri-implantitis. Flap surgery was undertaken, and in each case remnants of dental floss were found adhering to the roughened surface of the implant with peri-implantitis. The area was debrided, and nine of 10 patients had significant improvements.<sup>48</sup> The investigators then did in vitro testing and exposed a pristine implant to cleaning with dental floss. They found that floss left behind both fiber remnants and wax, leading the investigators to conclude that the use of dental floss may be a potential risk factor for peri-implantitis.<sup>48</sup>

Two studies have been conducted with the Water Flosser and implants.<sup>16, 41</sup> Magnuson et al. looked at the effectiveness of the Water Flosser in reducing bleeding around implants and compared

it to string floss. After 30 days, the Water Flosser group was more than twice as effective at reducing in bleeding versus subjects using string floss. (Figure 14). No adverse effects were reported for either group<sup>41</sup> Likewise Felo et al. found that the Water Flosser with 0.06% chlorhexidine delivered via a site specific tip was 87% more effective in reducing bleeding around implants than rinsing with 0.12% chlorhexidine.<sup>16</sup> A case-study by Salierno found that the Water Flosser was an effective component of the nonsurgical treatment of a case of mucositis.<sup>49</sup>

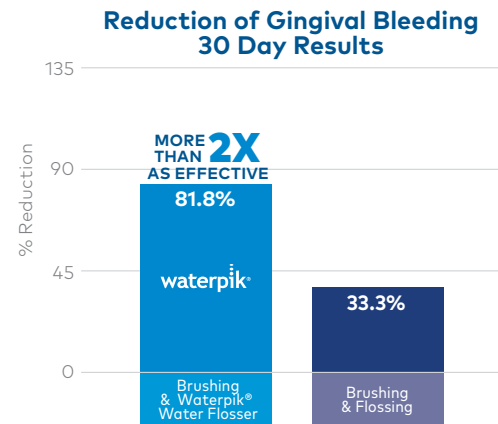


Figure 14: Reduction in bleeding around implants, Magnuson et al.<sup>41</sup>

[Click here to see the action of the water flosser around an implant](#)

**Non-flossers.** A common complaint of many dental professionals is that patients cannot, will not, or do not floss. Not surprisingly, a survey conducted for the American Academy of Periodontology found that more than a quarter of U.S. adults lie to their dentist about how often they floss. Over a third indicated they would rather do an unpleasant activity such as wash dishes, sit in traffic, or clean the toilet than use dental floss.<sup>50</sup> In the UK, 33% of adults admit to never flossing<sup>51</sup>, although the real number is suspected to be much higher.

As much as traditional string floss is stressed and preferred by dental professionals, the evidence does not support its superiority in improving oral health.<sup>52-54</sup> A systematic review by the prestigious Cochrane Collaboration<sup>®</sup> looked at the benefits of string floss as an addition to tooth brushing for the management of periodontal diseases and dental caries in adults. Their findings indicated that there was some evidence that the addition of floss to tooth brushing reduced gingivitis and very weak, unreliable evidence that it enhanced plaque reduction. The investigators also found that no studies had been conducted that provide evidence that flossing reduces caries in adults.<sup>52</sup> These findings are supported by Berchier et al.<sup>53</sup> and Hujoel et al.<sup>54</sup> Berchier et al. found that the addition of flossing to tooth brushing did not contribute to greater plaque and gingivitis reductions.<sup>53</sup> In regard to caries, Hujoel et al. found no clinical trials evaluating the effectiveness of flossing in adults.<sup>53-54</sup>

Both studies determined that dental professionals should determine on an individual basis whether high-quality flossing is an achievable goal.<sup>53,54</sup>

Five studies have compared the Water Flosser to string floss,<sup>28, 29, 30, 34, 41</sup> and three studies<sup>31,32,35</sup> have compared the Water Flosser to powered devices that work with air and small amounts of water. In each study, the Water Flosser has been shown to be superior.<sup>28-32, 34, 35, 41</sup> In a 28-day study of 106 subjects, Rosema et al.<sup>30</sup> found that the Water Flosser was twice as effective as string floss at reducing bleeding at 2 weeks (Figure 15). This is supported by Magnuson et al., who also found water flossing twice as effective at reducing bleeding over a 30-day period.<sup>41</sup> In regard to plaque biofilm, when either the Water Flosser or string floss was added to manual tooth brushing, the Water Flosser was 29% more effective than string floss.<sup>31</sup>

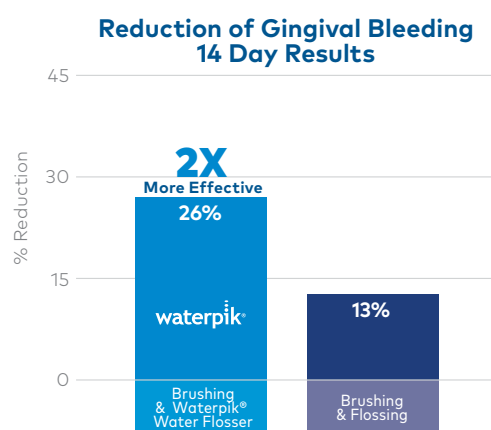


Figure 15: Reduction in bleeding versus string floss, Rosema et al.<sup>30</sup>

A study of 82 subjects over a 4-week period compared the Water Flosser to a device with air and a small amount of water. The results demonstrated that the Water Flosser was 80% more effective at reducing gingivitis and 30% more effective at reducing plaque than the first generation model of this product.<sup>32</sup> Similarly, Goyal et al., in a four-week study with 69 subjects, found that the Water Flosser was 54% better at reducing bleeding and 27% more effective at reducing plaque than the second generation model of this product<sup>35</sup> (Figures 16, 17, 18).

A study of 27 subjects compared the use of the Water Flosser to interdental brushes (IDB) over a two week time frame for plaque and bleeding on probing reduction. All subjects used a manual toothbrush. At the conclusion of the study the Water Flosser was 56% more effective than IDB at reducing BOP. For plaque, both groups had significant reductions from baseline.<sup>55</sup> A single-use plaque study also compared the Water Flosser and IDB and found the Water Flosser was 20% more effective than the IDB at removing plaque.<sup>56</sup>

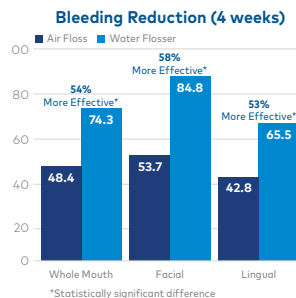


Figure 16: Bleeding reductions, Goyal et al.<sup>35</sup>

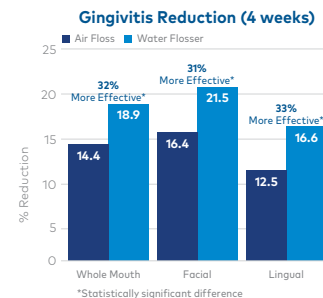


Figure 17: Gingivitis reduction, Goyal et al.<sup>35</sup>

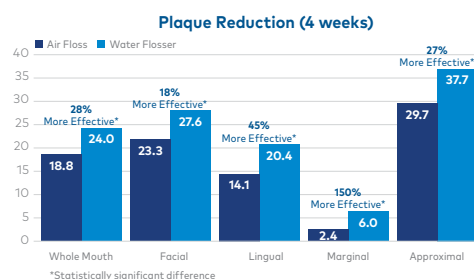


Figure 18: Plaque reductions; Water Flosser vs. Air Floss, Goyal et al.<sup>35</sup>

## THE SAFETY PROFILE OF THE WATER FLOSSER

The Water Flosser is supported by more than 70 published scientific studies and over 5 decades of use by the public. Both countertop and cordless models have earned the ADA Seal of Acceptance. Despite this, skepticism about product safety and efficacy still persists.<sup>57</sup> Some dental professionals believe the product cannot be used at higher settings; other feel it increases probing depth or destroys the attachment.



Figure 19: Use of the Water Flosser

A recent study by Goyal et al. evaluated the effect of the Water Flosser on gingival and epithelial tissue at multiple pressure settings; including the highest settings at 9 and 10. One hundred and five subjects were assigned to one of three groups; 1) manual brushing and Water Flossing, 2) manual brushing and flossing, and 3) manual brushing only. For the manual brushing and water flossing group, subjects

increased the pressure setting on the Water Flosser over the course of the six week study (Figure 19). The primary outcome measured was clinical attachment levels (CAL) as assessed from the cemento-enamel junction and probing pocket depth, PPD. At six-weeks, those in the Water Flosser group showed

an improvement in CAL and a reduction in PPD. These changes exceeded those in the manual brushing and flossing group and the manual brushing only group. All subjects received oral examinations at baseline, two-weeks, four-weeks, and six-weeks. All subjects were negative for oral lesions, trauma or any other abnormal findings at each visit. The investigators concluded that the Water Flosser is safe to use, and the results should alleviate concerns especially regarding pressure setting that the Water Flosser may negatively impact gingival health or epithelial tissue.<sup>57</sup>

The findings from Goyal et al support those concluded in a 2015 literature review, which found no data to support that the Water Flosser is detrimental oral health. The review looked at a wide range of studies. It covered topics such as trauma to soft tissue, penetration of bacteria into the sulcus, probing depth and bacteremia.<sup>2</sup>

Trauma to soft tissue was evaluated in a study at the University of Missouri Kansas City.<sup>7</sup> Investigators examined untreated, chronic periodontal pockets immediately following irrigation with the Water Flosser. Examination of specimens under a scanning electron microscope showed no observable differences between the irrigated and nonirrigated specimens concerning the physical features and appearance of the epithelium. The investigators concluded that the Water Flosser does not injure soft tissue.<sup>7</sup> This concurs with early work by Krajewski et al., who found less inflammation, better connective tissue organisation, and an increased thickness in the keratin layer in individuals who used a Water Flosser twice daily compared to those who did not.<sup>58</sup>

Penetration and disruption of bacteria into the pocket have been studied by various researchers.<sup>7, 8, 22, 23, 37, 38, 42</sup> Dr. Charles Cobb et al. evaluated the reduction of pathogens with a scanning electron microscope and found that areas treated with a Water Flosser had significantly less bacteria, up to 6 millimeters compared to areas that had not been water flossed.<sup>7</sup> These results are supported by Dr Connie Drisko et al., who also found reduction of spirochetes up to 6 millimeters.<sup>8</sup> Others also have found water flossing over a course of 3–6 months reduces periodontal bacteria.<sup>22, 38, 44</sup> Collectively, these findings indicate that the potential for the Water Flosser to force bacteria into the pocket is highly unlikely.

Pocket depth has been evaluated in several studies, and none has found an increase in probing readings from the daily use of the water flosser.<sup>20, 21, 23, 25, 26, 38, 40, 41, 43</sup> Cutler et al. found that the Water Flosser reduced probing depth by 0.4 mm in a 2-week time span.<sup>26</sup> This is supported by Newman et al.,<sup>20</sup> Flemmig et al.,<sup>21, 25</sup> and Chaves et al.,<sup>22</sup> who found either small improvements or stable probing depths in periodontal maintenance patients who used the Water Flosser for a period of 6 months.

Bacteremia is a concern of dental professionals. The incidence of bacteremia from using a Water Flosser has been studied on numerous occasions.<sup>59-62</sup> Post-water flossing, in people with gingivitis, the bacteremia rate was shown to be 7%,<sup>59</sup> while in

those with periodontitis showed 50%.<sup>60</sup> For people with no history of periodontal disease and no evidence of gingivitis, Berger et al. found a 27% rate of bacteremia,<sup>61</sup> whereas Tamimi et al. found no subjects developed bacteremia<sup>62</sup> after using the device. This is similar to traditional tooth brushing and flossing at 20%-68% or mastication, up to 51%.<sup>63</sup>

## WHAT SHOULD I TELL PATIENTS ABOUT USING THE WATER FLOSSER?

Compliance is enhanced when people enjoy using a product. Data indicate that people like and regularly use the Water Flosser.<sup>17,21, 22,</sup>

<sup>25,64</sup> Hoover and Robinson noted that subjects felt that using the Water Flosser was a pleasant experience and that their mouths felt cleaner.<sup>17</sup> Lainson et al. documented similar comments such as, "It stimulated the gums and made the teeth feel cleaner."<sup>64</sup>

Mouthwash can be used in the Water Flosser to enhance compliance or for medicinal purposes. Almost any solution or mouth rinse can be used in a Water Flosser. When using something other than water, the unit must be flushed by partially filling the reservoir 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>7, 8, 15, 17, 20-22, 25-29, 30, 33-35, 40-43, 56, 58, 64</sup>
- Chlorhexidine<sup>16, 22, 24, 25, 37, 39, 43</sup>
- Essential Oils<sup>23, 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>16, 22, 24, 25, 37, 39, 43</sup> One of the benefits of using CHX is 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>39</sup>
- 0.04% = 3 parts water + 1 part CHX<sup>22, 37</sup>
- 0.06% = 1 part water + 1 part CHX<sup>16, 24, 25, 43</sup>

Essential oil mouthwash has also been studied as an irrigant.<sup>23, 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 oils is based on studies using it at full strength only. However, because water works, dilution is acceptable.

Instructions are an important component in water flossing. One of the best ways to give good instructions is to try the product. When giving instructions for the use of the Water Flosser, some general suggestions can make learning how to use it an easy and quick process.

- Read all manufacturer's instructions prior to use.
- For practical purposes, don't start the flow of water until the tip is in the mouth.
- Bend from the waist over the sink and hold arm up perpendicular to torso (**Figure 19**).
- Lips should be slightly closed to avoid splashing, but open enough to allow the water to flow freely from the mouth into the sink.
- Focus the eyes on the sink not the mirror
- Before removing the tip from the mouth, pause the flow of water or turn the unit off.
- For comfort, recommend using warm water or room temperature solutions.
- First time users should begin at the lowest pressure setting and increase as comfortable.

[Click here to watch a short video on how to use the water flosser](#)

## WHICH MODEL AND TIP IS BEST FOR MY PATIENT?

When considering which type of model to recommend, lifestyle and personal preferences should be determining factors. The two basic types of models, countertop and cordless, have a pulsation rate and pressure range consistent with what is needed to achieve



Figure 20: ADA Seal of Acceptance

clinical outcomes. The ADA Council on Scientific Affairs has awarded the Waterpik® Water Flosser the Seal of Acceptance based on its findings that the product is safe and has shown efficacy for removing plaque along the gumline and between teeth and helping to prevent and reduce gingivitis, when used as directed. (**Figure 20**)

The Waterpik® Ultra Professional Water Flosser (**Figure 21**) is the top-of-the-line product in the Water Flosser category. It has a sleek design and features two water flossing modes: floss for the ultimate in interproximal cleaning and hydro pulse massage for enhanced gingival stimulation and circulation. The



Figure 21: Waterpik® Ultra Professional Water Flosser

unit features an upgraded on/off water control on the handle to control the flow of water at the fingertip. The Ultra Professional has a 1-minute timer and 30-second pacer for optimized cleaning of all areas of the mouth. The large reservoir provides 90 seconds of cleaning. It has 10 pressure settings and comes with seven tips.

The Waterpik® Whitening Professional Water Flosser (**Figure 22**) delivers precision whitening while patients reap the benefits of Water Flossing. The Whitening Water Flosser provides the



Figure 22: Waterpik® Whitening Professional Water Flosser



Figure 23: Before.



Figure 24: After 2 weeks of using the Waterpik® Professional Whitening Water Flosser

same features as the Waterpik® Ultra Professional along with whitening infuser technology in the handle for gentle stain removal. It has been shown to remove 25% more stain at 2-weeks than toothbrushing alone.<sup>65</sup> (**Figures 23 & 24**) It comes with one 30 count bottle of whitening tablets.

Waterpik® Sonic-Fusion® (**Figure 26**) is the newest addition to the Waterpik® family of oral health products. It combines the power of sonic toothbrushing with the proven efficacy of Water Flossing to deliver a complete clean in one step. Sonic-Fusion® has been shown to be up to twice as effective as manual brushing and flossing for reduce plaque, bleeding, and gingivitis.<sup>66</sup>



Figure 26: Waterpik® Sonic-Fusion®

The Waterpik® Cordless Advanced (Figure 27) features a new state of the art charging system. A microprocessor controls the charging system proving long battery life and recharging only takes four hours. LED indicator lights provide at-a-glance status for pressure and battery charge. The unit also has global voltage and comes with a tip storage case and travel bag. For those who like to water floss in the shower, the unit is waterproof. The Cordless Advanced has three pressure settings and comes with four tips. It is available in four designer color options.



Figure 27: Waterpik® Cordless Advanced Water Flosser®

Five different types of tips are available to be used on the Waterpik® Water Flosser, allowing for a customized approach depending on individual patient needs (Figure 28). The standard jet tip is also called the Classic Jet Tip and it is for generalized cleaning. The Orthodontic Tip is ideal for those in orthodontic appliances. The Plaque Seeker® is a great choice for implant patients, and the Pik Pocket® Tip helps people access difficult

to clean areas such as deep pockets, furcations, and around crowns and bridges.

Figure 28: Five Unique Tips for Individual Needs



**Classic Jet Tip:**  
Good for general cleansing



**Orthodontic Tip:**  
Perfect for orthodontic appliances



**Plaque Seeker® Tip:**  
Best for veneers, implants, crowns, and bridges



**Toothbrush Tip:**  
For patients who want to brush and water floss simultaneously



**Pik Pocket® Tip:**  
Ideal for periodontal pockets, furcations, hard to access areas, delivery of medicaments

Use the Classic Jet Tip, Plaque Seeker® Tip, Orthodontic Tip,

#### or 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-degree angle to the long axis of the tooth at the interproximal space (Figure 29).
- After the unit has been turned on and water has begun pulsating, hold the tip in place at the interproximal area for 3 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 regions.
- 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. It is latex free. Because this tip is site-specific, individuals will need to know exactly where in the mouth it should be used. It is also best used with a countertop model.

- Turn the unit to the lowest pressure setting. If the user forgets, the pressure will still emit at 20 psi, though failure to do this may shorten the life of the unit (Figure 30).
- Gently place the tip just slightly below the gingival margin (Figure 31)
- Use a mirror to check that the tip is in the correct place.
- Briefly hold the tip in place before proceeding to another area.

## SUMMARY

Since its introduction in 1962, the Water Flosser has been evaluated in numerous clinical trials that have demonstrated its safety and efficacy. It has been shown to benefit a wide variety of patients and clinical considerations including people with orthodontic appliances, implants, diabetes, in periodontal maintenance, and non-flossers. A wide array of units that can fit the lifestyle of anyone are available.

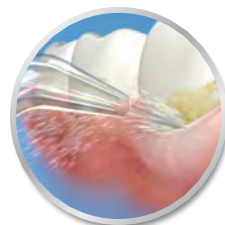


Figure 29: Placement of the Classic Jet Tip



Figure 30: Turn the dial to the lowest setting to use the Pik Pocket® Tip



Figure 31: Placement of the Pik Pocket® Tip

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# POST TEST FOR COURSE #18-29:

## The Water Flosser: Your Tool For Optimal Oral Health

- 1. Which statement is true regarding pulsation and pressure?**
  - a. It is less effective than a steady stream.
  - b. It is similar to swishing.
  - c. It doesn't allow the solution to penetrate into pocket.
  - d. It produces sheer hydraulic forces capable of removing plaque biofilm.
- 2. On average, the estimated depth of delivery into the sulcus using the jet tip at a 90 degree angle is:**
  - a. 10% of the depth of a pocket.
  - b. 20% of the depth of a pocket.
  - c. 50% of the depth of a pocket.
  - d. 100% of the depth of a pocket.
- 3. Which statement is true regarding the water flosser and plaque biofilm removal?**
  - a. The water flosser was 29% more effective at removing plaque than string floss.
  - b. The water flosser removed 82% of approximal plaque compared to 63% for string floss.
  - c. Teeth water flossed for 3 seconds at medium pressure had 99.9% plaque removal.
  - d. All statements are true.
- 4. People who added water flossing to power tooth brushing got better results in reducing:**
  - a. Stain
  - b. Food debris
  - c. Bleeding and gingivitis
  - d. Halitosis
- 5. To what depth have researchers found the water flosser reduces pathogenic bacteria?**
  - a. 4 mm
  - b. 6 mm
  - c. 8 mm
  - d. 12 mm
- 6. How much more plaque did the water flosser remove in orthodontic patients compared to string floss?**
  - a) 3.76 times as much
  - b) 4.25 times as much
  - c) 6.15 times as much
  - d) 7.68 times as much
- 7. Which product has been implicated as a possible risk factor for peri-implantitis?**
  - a. Power toothbrushes
  - b. Water flossers
  - c. Traditional dental floss
  - d. Mouthwash
- 8. When used with implants, the water flosser was how much more effective than string floss at reducing bleeding?**
  - a. 8 times more
  - b. 6 times more
  - c. 4 times more
  - d. 2 times more
- 9. Water flossing for 30 days post-SRP has been shown to be as effective as what other regime?**
  - a. SRP plus regular dental flossing
  - b. SRP plus power tooth brushing only
  - c. SRP plus the local delivery of an antibiotic agent
  - d. SRP plus systemic antibiotics
- 10. Which statement is true about dental floss?**
  - a. Studies prove it is the best tool for interproximal plaque removal.
  - b. Studies prove it reduces interproximal caries.
  - c. Studies prove it is the best device for reducing gingivitis.
  - d. There is little to no evidence supporting the superiority of string floss over other devices.
- 11. How many published studies have been conducted on the water flosser?**
  - a. Over 100
  - b. Over 70
  - c. Less than 50
  - d. Less than 35
- 12. Regarding the safety of the Water Flosser, which statement is true?**
  - a. The water flosser does not injure the soft tissue of the epithelium.
  - b. The water flosser does not force bacteria into the pocket.
  - c. The bacteremia produced by the water flosser is similar to brushing and flossing.
  - d. All of the above.
- 13. Which statement is true regarding the use of mouthwash in a water flosser?**
  - a. Most types of mouthwashes can be used in the water flosser.
  - b. The water flosser should be flushed with water after using mouthwash.
  - c. Dilute chlorhexidine and an essential oil mouth rinse have been tested in a water flosser.
  - d. All of the above.
- 14. How many different types of tips are available for the Water Flosser?**
  - a. 2
  - b. 4
  - c. 5
  - d. 6
- 15. Which statement is true when using a Water Flosser?**
  - a. Do not start the flow of water until the tip is in the mouth.
  - b. Bend from waist over the sink and avoid looking in the mirror.
  - c. Use warm or room temperature water.
  - d. All of the above.

## OBTAINING CPD

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Contact: Judith Holtkuile - European Professional Marketing Manager, by email: [judith.holtkuile@churchdwright.com](mailto:judith.holtkuile@churchdwright.com)

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