waterpik™

THE WATER FLOSSER: HARNESSING THE POWER OF WATER TO ACHIEVE OPTIMAL ORAL HEALTH

Course #24-36

DISCLOSURE STATEMENT

- The content for this self-study course was written by Carol A. Jahn, RDH, MS, and Sue Scherer, RDH, BS.
- Carol Jahn, RDH, MS and Sue Scherer, RDH, BS are employees 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 DESCRIPTION

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 patients 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, inflammation and bleeding
- Compare the use of the water flosser to string floss
- Evaluate solutions and agents for use in a water flosser
- Understand the benefits of a water flosser for individuals with gingivitis, periodontitis, implants, diabetes, orthodontics
- Instruct patients in the use of the water flosser
- Recommend the water flosser to appropriate individuals including when to implement the Precision Tip, Plaque Seeker™ Tip, Pik Pocket™ Tip, Orthodontic Tip or Implant Denture Tip.

INTRODUCTION

Water flossing is a well-established homecare regimen that has been around for more than sixty years. The Waterpik™ water flosser was created by a dentist, Dr. Gerald Moyer, and his patient, John Mattingly, an engineer, in 1962 to help patients with periodontal disease **(Figure 1)**. Since its inception, more than eighty research studies have been conducted that back the safety and efficacy of the Waterpik water flosser[1,2] These studies have been conducted at university- and research-based facilities by experienced investigators and published in peer-reviewed journals.

Figure 1:
The first water flosser called the Octopus.

Additionally, eight independent research reviews found water flossing is superior to traditional home care methods for reducing inflammation, bleeding and gingivitis.[3-10]

Backed by more than six decades of scientific evidence, the Waterpik water flosser is the first in its class to earn the prestigious American Dental Association (ADA) Seal of Acceptance. For a product to qualify for the seal, it must have data from clinical and/or laboratory studies that demonstrate safety and efficacy according to product category requirements developed by the ADA Council on Scientific Affairs.[11]

Many dental professionals encounter patients who could do better with their plaque control and consequently bleed at every visit. These also tend to be the same patients who can't, won't or don't like to use dental floss. For this reason, there is a need to find an alternate recommendation that patients will like and use so they can improve and maintain optimal oral health. Studies show water flossing can reduce clinical parameters such as plaque biofilm accumulation, bleeding, gingivitis, inflammation, calculus, probing depths, and periodontal pathogens.[1] Patients who are poor brushers, non-flossers, have dental implants, are a periodontal maintenance patient or undergoing orthodontic treatment benefit from incorporating the water flosser into their daily routine.[12]

Over the past ten years water flossing has become a mainstream recommendation by dental professionals. This has led to many different water flossers appearing on the market, in both retail stores and online. However, not all water flossers are created equal. The quality of the unit has a direct impact on the patient's experience while water flossing. Dental professionals may see reduced compliance and efficacy when patients purchase an off-brand water flosser.

When recommending home care devices dental professionals should use evidence-based decision making to support the recommendation and ensure their patients invest in a quality product.[13] First, examine what the current scientific evidence says about the device. Second, implement professional expertise: that is, has it worked well for other patients, and/or have you tried the product for yourself? Third, are you familiar with the company and their reputation? Do you have the confidence they will stand by their product? Last, consider the patients' needs and preferences. If the patient can't, won't, or doesn't floss, it is necessary to find an alternate recommendation that is clinically shown to help achieve optimal oral health outcomes.

HOW THE WATER FLOSSER WORKS

The combination of pulsation and pressure is the critical mechanism of action behind the Waterpik water flosser. Unlike a steady stream of water, the combination of pulsation and pressure creates shear hydraulic forces capable of removing plaque biofilm.[14] When compared to a steady stream of water, a pulsating device has been shown to be three times as effective at removing debris.[15]

Click here to see a video of a water flosser removing plaque biofilm.

Figure 2: Precision Tip

Evidence indicates that the Waterpik water flosser is one of the best devices for subgingival access into the periodontal pocket.[16-20] The pulsation and pressure of water creates a compression and decompression phase that allows for subgingival penetration into the sulcus or pocket. Cobb et al. and Drisko et al. both found that water flossing with a Precision Tip **(Figure 2)** can reduce periodontal pathogens up to 6 millimeters.[17,18]

Click here to view the depth of penetration from a precision tip

PERIODONTAL HEALTH: REDUCING CLINICAL PARAMETERS THAT CONTRIBUTE TO INFLAMMATION

The American Academy of Periodontology (AAP) defines periodontal health as a state free from inflammatory periodontitis.[21] A patient who presents with less than 10% bleeding and probing depths of 4mm or less would be considered in periodontal health.[3] To help patients achieve and maintain periodontal health, it is crucial to prioritize both professional and homecare interventions. Research has shown that daily water flossing is an effective method to prevent and reduce gingival inflammation.[5,9,10] By incorporating water flossing into their oral hygiene routine, individuals can effectively reduce plaque biofilm, gingivitis, and bleeding, which are risk factors for periodontitis.[1]

Plaque biofilm. Maintaining oral health and minimizing inflammation requires regular disruption of plaque biofilm. For many years, it was widely believed that water flossing could not remove plaque biofilm. However, since 2000, thirteen studies have been conducted, all of which have reported positive findings regarding water flossing and its ability to remove plaque biofilm.[5,22-33]

A study conducted at the University of Southern California Center for Biofilms evaluated the effect of the Waterpik water flosser on plaque biofilm using scanning electron microscopy (SEM).[14] 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 3)**. The teeth were water flossed for three seconds at a medium pressure setting. Post-SEM images found that water flossing removed 99.9% of plaque biofilm[14] **(Figure 4)**. The researchers observed the action of the water flosser under the SEM and determined the unique combination of pulsation and pressure creates shear hydraulic forces, that are responsible for the gentle yet powerful removal of plaque biofilm from tooth surfaces.[14]

Figure 3: Before treatment with the water flosser, Gorur et al.[5]

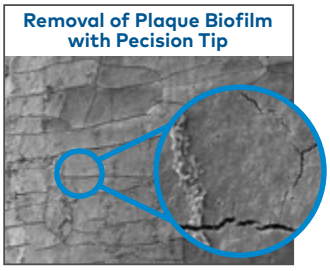

Figure 4: Tooth surface after a 3-second treatment with the water flosser, Gorur et al.[5]

Additional research evaluated the plaque biofilm removing capabilities of the Waterpik water flosser in a single-use study. Seventy adults abstained from all oral hygiene for twenty-three to twenty-five 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.[30] The water flosser also removed nearly 82% of approximal plaque compared to 63% for string floss.[30] These findings are supported by Sharma et al., who found the Waterpik water flosser removed 75% of whole mouth plaque and 83% of approximal plaque.[28]

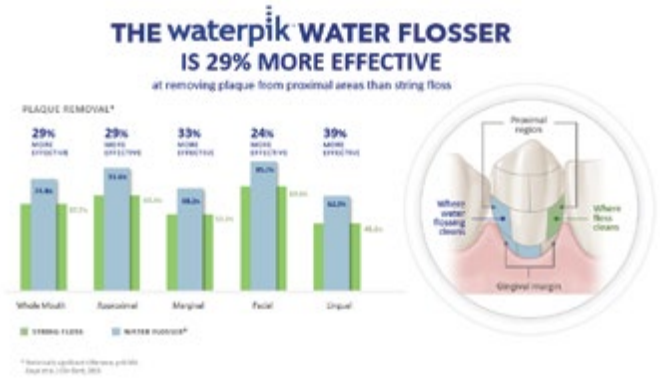

Table 1: Proximal region: Where water flossing cleans versus string floss

Gingivitis and bleeding. Bacterial plaque biofilm is a crucial factor in the development of gingivitis and periodontal disease. However, it is now widely recognized that individuals can have varying responses to plaque biofilm, resulting in differences in the severity and extent of periodontal disease. Some individuals may be more susceptible to the effects of plaque biofilm, whereas others may have a significant amount of plaque but never progress beyond gingivitis.[34] As a result, it has been found that the absence or reduction of bleeding is a more significant indicator of periodontal health than the absence or reduction of plaque biofilm.[3] Several studies have shown that the Waterpik water flosser is an extremely effective home care device to help patients reduce gingivitis and bleeding.[3-5,22-29,31-33,35-50]

Kotsakis et al. recently conducted a systematic literature review that included twenty-two randomized clinical trials.[5] The objective of this review was to assess the effectiveness of ten different interdental oral hygiene aids in reducing clinical indications of inflammation. Interdental brushes and water flossers were found to be the two most effective in reducing the gingival index.[5] Similarly, Liang et al. conducted a meta-analysis that yielded similar results.[4] Both meta-analyses concluded that toothpicks and dental floss were ranked lowest in terms of their effectiveness in reducing gingivitis and bleeding.[4,5]

A recent clinical study compared the efficacy of water flossing versus dental floss for reducing bleeding.[32] Lyle et al. found that the Waterpik water flosser was up to two times as effective as string floss at reducing whole mouth bleeding. [32] **(Figure 5)** This study concluded that water flossing is more effective than dental floss for improving gingival health over a four-week period.[32]

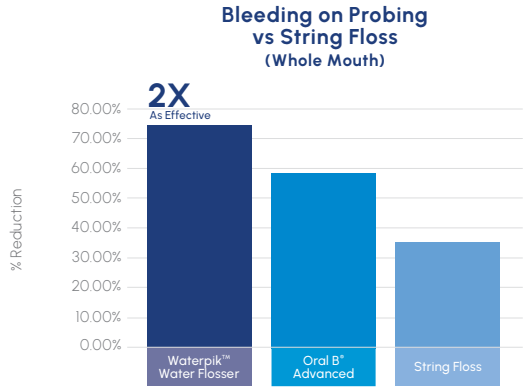

Figure 5: Reduction in bleeding versus string floss, Lyle DM.

Periodontal pathogens. Several studies have demonstrated that water flossing can effectively reduce the pathogens responsible for initiating periodontal infections.[17,18,40,41,44,45,50,51] Additionally, the water flosser has shown the ability to reduce the inflammatory mediators that contribute to attachment loss and bone loss in periodontal disease.[22-23] Cutler et al. found that when patients added a Waterpik water flosser to their daily oral hygiene routine there was a significant improvement in clinical measures of mild to moderate periodontitis.[22] Unlike routine oral hygiene the addition of the water flosser is capable of reducing pro-inflammatory cytokine production in the gingival crevicular fluid.[22]

The water flosser's ability to disrupt the subgingival flora has a positive influence inhibiting disease activity and resulting in improved periodontal health.[22] Ge et al. evaluated the effect of water flossing versus string flossing on the subgingival microbiome composition in patients with naturally occurring gingivitis. The water flosser group demonstrated a greater reduction in periodontal pathogens, a higher abundance of commensal bacteria, and a substantial reduction in multiple species of anaerobic bacteria and had greater reduction in multiple Treponema species versus string floss.[51]

Cobb et al. and Drisko et al. demonstrated that a Waterpik water flosser with water reduced bacteria at depth of up to 6 mm.[17,18] Likewise, Chaves et al. found the Waterpik water flosser with either water or diluted chlorhexidine (CHX) reduced subgingival pathogens.[40] In comparison, they found rinsing with full-strength CHX did not achieve the same results.[40]

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.[22] Cutler et al. looked at traditional periodontal outcomes plus measures of cytokines, also called inflammatory mediators.[22] Cytokines were chosen because some, such as IL-1ß, have been implicated in stimulating osteoclasts to destroy alveolar bone.[52,53] The investigators discovered that water flossing reduced crevicular cytokine levels, most notably IL-1ß, thus potentially inhibiting periodontal disease activity. It is important to note that measures of the cytokines were taken eight hours after use of the water flosser so that any dilution effect would be eliminated.[22] A University of Buffalo study also found that water flossing reduced the production of serum IL-1ß.[23]

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 mm to 0.4 mm.[22,38,39,41,43,44,46,47,49] The clinical significance of these findings lends support to the safety of the Waterpik water flosser as well as its potential for helping periodontal maintenance patients maintain stability.

Goyal et al. conducted a randomized clinical trial to evaluate the effect water flossing at different pressure settings has on clinical attachment levels (CAL) and periodontal probing depths (PPD). One hundred and five participants were randomized into one of three groups: Waterpik water flosser and manual toothbrush, dental floss and manual toothbrush, and manual toothbrush only. The study showed the water flossing group exceeded the dental floss and manual toothbrush only groups for improvement in CAL and reduction of PPD over six-weeks.[54]

PATIENTS THAT BENEFIT FROM USING A WATER FLOSSER

There are many patients who can benefit from water flossing. Non-flossers; poor brushers; people with implants, crowns, or bridges; those in periodontal maintenance; and those who are undergoing orthodontic treatment can all benefit from adding a water flosser to their daily routine. 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.[24-33]

Non-flossers. Approximately one in three adults in the United States report flossing daily.[55] Not surprisingly, a survey conducted for the American Academy of Periodontology (AAP) 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.[56]

As much as traditional string floss is stressed and preferred by dental professionals, the evidence does not support its superiority over other products in improving oral health.[57-59] This is not to imply flossing doesn't work but rather a high level of skill is required to achieve good health outcomes.[5] Additionally, other products have been shown to perform as well if not better in many cases than string floss for removing plaque and reducing bleeding.[4,5,9,10]

A systematic review by the prestigious Cochrane Collaboration® looked at the benefits of string flossing 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 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.[57] These findings are supported by Berchier et al.[58] and Hujoel et al.[59] Berchier et al. found that the addition of flossing to tooth brushing did not contribute to greater plaque and gingivitis reductions.[58] In regard to caries, Hujoel et al. found no clinical trials evaluating the effectiveness of flossing in adults.[59] Both studies determined that dental professionals should determine on an individual basis whether high-quality flossing is an achievable goal.[58,59]

Seven studies have compared the Waterpik water flosser to string floss.[24-26,30,32,48,51] In each study, the water flosser has been shown to attain a superior result.[24-26,30,32,48,51] A recent clinical study found water flossing to be up to twice as effective for reduction of whole mouth bleeding and removing plaque.[32] When comparing the efficacy of water flossing versus string flossing in the proximal region water flossing was up to seven times as effective for removing plaque, up to twice as effective at reducing bleeding and 90% more effective at reducing gingivitis.[32] **(Figure 6, 7)** This is supported by Rosema et al.[26] who found the Waterpik water flosser was twice as effective as string floss at reducing bleeding at two weeks.

A study of twenty-seven subjects compared the use of the Waterpik 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.[60] 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.[61]

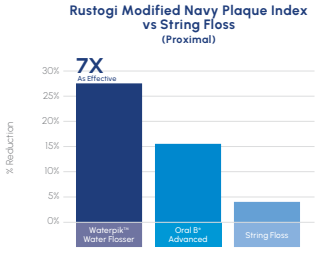

Figure 6: Efficacy of water flossing versus string floss, Lyle DM.

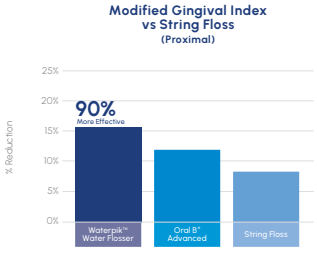

Figure 7: Efficacy of reducing gingivitis, Lyle DM.

Periodontal maintenance. Statistics indicate that nearly half of U.S. adults aged 30 and older have periodontitis.[62] This fact suggests that helping people prevent and arrest periodontal disease is a top concern for most dental practices. A systematic review by Sanz et al.[3] aimed to implement the new AAP Classification System of Staging and Grading and addressed the necessity for specifically designed periodontal care. This review looked at professional and homecare therapies for treating periodontal patients. The reviewers emphasized homecare interventions should be based on the best evidence available and patient preferences. Historically, dental floss has been widely accepted as the gold standard for interdental cleaning. However, due to its limited ability to remove plaque and reduce gingival inflammation Sanz et al. concluded that string flossing is not the recommended method for periodontal maintenance patients.[3]

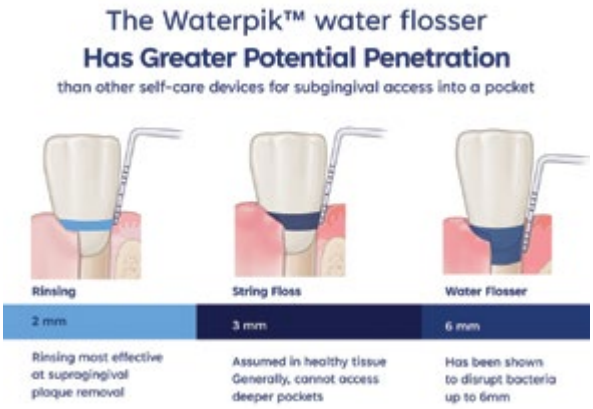

Figure 8: Comparison of three different self-care methods ability to access subgingivally

Conventional wisdom, rather than scientific evidence, says that traditional dental floss can access only up to 3 mm subgingival. **(Figure 8)** Therefore, this interdental oral hygiene method falls short of disrupting bacteria in periodontal pockets. Altalhi et al. conducted a comparative review of water flossers in periodontal therapy. The researchers reviewed forty-eight studies conducted between 1962 and 2023 that evaluated the efficacy of water flossing versus the following:

- Traditional dental floss
- Interdental brushes
- Interdental tape
- Electric flossers
- Wooden toothpicks

Altalhi et al. concluded that current literature consistently supports the efficacy of water flossing and demonstrates its superiority to other traditional methods in the management of periodontitis.[9] The well-established body of evidence supports the dental professional recommendation for periodontal maintenance patients to incorporate water flossing into their daily routine to improve and maintain optimal oral health.[22,23,38-46,49]

A study by Genovesi et al. evaluated the difference between scaling and root planning (SRP) followed by the local delivery of minocycline or SRP followed by daily water flossing for thirty days. The results demonstrated that both treatments effectively reduced bleeding on probing and improved pocket depth and clinical attachment at thirty days.[49] **(Figures 9, 10, 11)** There were no statistical differences between the groups, thus showing that the Waterpik water flosser is an effective alternative to subgingival antibiotics for periodontal maintenance patients over a thirty-day period.[49]

Several six-month studies were conducted during the 1990s on periodontal maintenance patients.[38-40,43 ,39,42] Findings from these studies consistently showed that the Waterpik water flosser improved the oral health of this demographic. Notably, water flossing is extremely

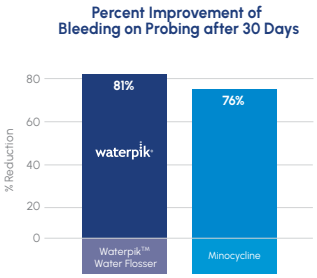

Figure 9: BOP reduction in periodontal maintenance patient, Genovesi et al.[42]

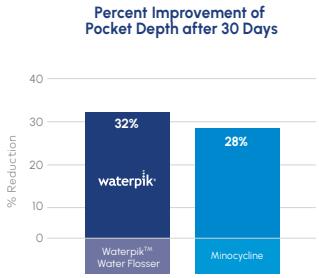

Figure 10: Probing depth improvements in periodontal maintenance patients, Genovesi et al.42

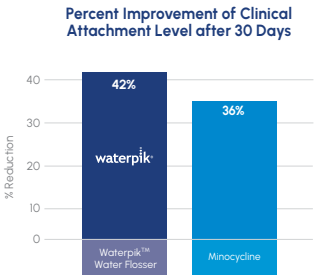

Figure 11: CAL improvement in periodontal maintenance patients, Genovesi et al.[42]

effective at reducing bleeding upon probing (BOP). Flemmig et al. found that water flossing reduced BOP by half over the six-month time frame,[39] and Newman et al. showed that those with the most BOP had the greatest reductions.[38] In a different study, Flemmig et al. found that water flossing was more effective than rinsing with 0.12% chlorhexidine at reducing BOP.[43]

Implants. Three million people in the Unites States have dental implants and that number is growing by 500,000 annually.[64] Patients with dental implants are vulnerable to both mucositis and peri-implantitis.[65,66] Research shows that patients with a history of periodontitis have a 74% greater risk for peri-implant disease.[67]

The risk of peri-implant disease can be reduced with routine professional maintenance and good homecare practices.[67]

Water flossing 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.[48,65] A quantitative survey of more than two thousand dental hygienists revealed that water flossing is the most commonly recommended self-care device for patients with dental implants.[68] Water flossers are usually well accepted by patients and demonstrate significant reduction in BOP in patients with peri-implant disease.[69] **(Figure 12)**

Figure 12: Plaque Seeker Tip

Ng and Lim reviewed the effectiveness of different interdental oral hygiene methods and their ability to reduce clinical parameters around dental implants. The review concluded water flossing should be recommended over dental floss for cleaning around implants.[10] This is due to the ability of water flossing to safely disrupt subgingival plaque resulting in reduction of gingival inflammation and the potential for floss to fray on rough surfaces leading to peri-implant disease.[10]

Click here to see the action of the water flosser around an implant

An observational study at the Academic Centre for Dentistry Amsterdam reported on ten 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 ten patients had significant improvements.[70] 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.[70]

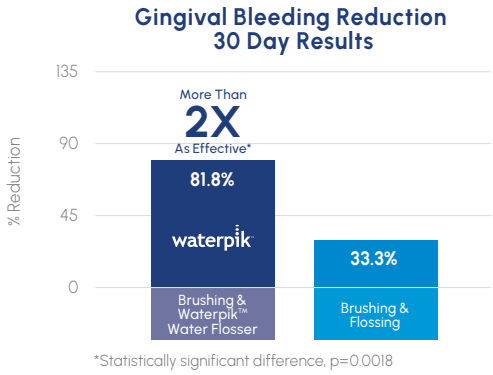

Figure 13: Reduction in bleeding around implants, Magnuson et al.[41]

Two studies have been conducted with the Waterpik water flosser and implants.[48,65] Magnuson et al. looked at the effectiveness of the water flosser in reducing bleeding around implants and compared

it to string floss. After thirty days, the water flosser group was more than twice as effective at reducing bleeding versus subjects using string floss.[41] **(Figure 13)** No adverse effects were reported for either group.[48] A case-study by Salierno found that the water flosser was an effective component of the nonsurgical treatment of a case of mucositis.[71]

Orthodontics The water flosser has long been the ideal device for people in orthodontic treatment.[25,47] Orthodontic appliances present significant cleaning challenges for patients of any age. A study of one hundred and six adolescents eleven to seventeen years of age compared manual tooth brushing plus a Waterpik water flosser with a tip designed specifically for orthodontic appliances **(Figure 14)** to two other groups: manual tooth brushing plus flossing via a floss threader and 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.[25] **(Figures 15 & 16)** These results are in line with a study on adult orthodontic patients that found, regardless of whether manual or power toothbrushes were used, adding a water flosser provided significantly better reductions in bleeding and inflammation.[47]

Figure 14:
Orthodontic Tip

Click here to see the use of the orthodontic tip

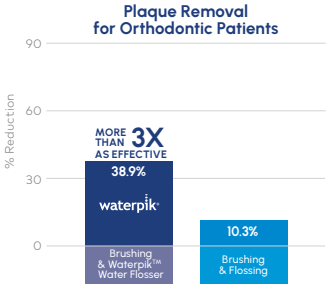

Figure 15: Reduction of plaque versus string floss, Sharma et al.[29]

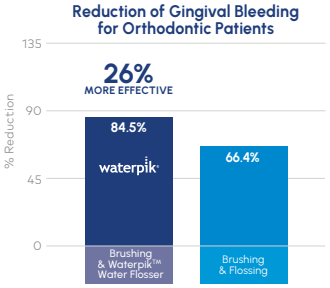

Figure 16: Reduction of gingival bleeding versus string floss, Sharma et al.[29]

Diabetes is recognized as one of two significant risk factors for developing periodontal disease according to the AAP Staging & Grading classification system.[72] Patients with diabetes have a two to three times higher risk of developing periodontitis compared to those without diabetes.[72,73] This increased risk is due to uncontrolled blood glucose levels that can delay wound healing and contribute to gingival inflammation.[74,75] Research has suggested that patients with diabetes benefit from periodontal therapy in conjunction with good self-care practices.[74]

A study at the University of Buffalo looked at how the Waterpik 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-1ß and PGE2.[23]

BENEFITS OF COMBINING WATER FLOSSING WITH POWER BRUSHING

Research has found that no matter what type of toothbrush is used, manual or electric, up to 40% of plaque remains.[76] This is correlated to the limited ability of a toothbrush to clean interproximally and subgingivally. Incorporating a water flosser into the brushing routine has been shown to significantly improve oral health.

Lyle et al. compared the effectiveness of a manual toothbrush alone, a sonic toothbrush alone, and a sonic toothbrush paired with a Waterpik water flosser. The sonic toothbrush paired with the water flosser was superior to both manual and toothbrushing alone for reducing bleeding, gingivitis and plaque.[77] When compared to manual brushing alone, the sonic toothbrush paired with a water flosser was up to three times as effective for reducing bleeding, up to two times as effective for reducing gingivitis, and where it really counts with plaque in the proximal area, up to five times as effective for plaque removal.[77] **(Figure 17, 18, 19)**

Figure 17,18,19: Sensonic™ Complete Care is up to 3x as Effective as Brushing Alone for Improving Gingival Health and up to 5X as Effective for Removing Plaque in Hard-to-Reach Areas.

A four-week clinical trial compared the use of an oscillating-rotating powered toothbrush and Waterpik water flosser to the use of an oscillating-rotating powered toothbrush alone on the reduction of clinical signs of inflammation and plaque. The water flosser group was 37% more effective at reducing bleeding on probing, 36% more effective reducing gingival inflammation and 33% more effective

reducing plaque than an oscillating-rotating powered toothbrush alone for whole mouth scores.[78] The water flosser group was also significantly more effective at reducing proximal scores. The water flosser group was 37% more effective for reducing proximal bleeding on probing, 46% more effective at reducing proximal inflammation and 52% more effective at reducing proximal plaque.[78]

In a University of Nebraska study, the Waterpik 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 either a manual or power brushing routine was a more effective alternative to string floss for the reduction of bleeding, gingivitis, and plaque.[24] Notably, the water flosser was up to 93% better at reducing bleeding and up to 52% better at reducing gingivitis over manual flossing.[24] 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.

Goyal et al. evaluated a novel sonic toothbrush that allows patients to brush, water floss or do both at the same time. The study compared the effectiveness of the novel sonic toothbrush to a traditional sonic toothbrush and manual brushing and string flossing, on gingival inflammation and plaque scores. The subjects brushed for two minutes followed by one minute of water flossing. The researchers concluded that the novel sonic toothbrush with water flossing is twice as effective as manual toothbrushing and string flossing for reducing plaque, gingival bleeding and inflammation.[79]

THE SAFETY DATA OF THE WATER FLOSSER

The Waterpik water flosser is supported by more than eighty published scientific studies and over six decades of use by the public. Both countertop and cordless models have earned the ADA Seal of Acceptance. **(Figure 20)** Despite this, skepticism about product safety and efficacy persists.[54] Some dental professionals believe the product cannot be used at higher settings; others feel it increases probing depth or destroys the attachment.

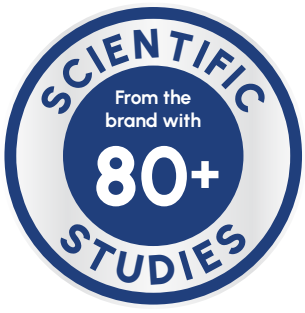

Figure 20

A study by Goyal et al. evaluated the effect of the Waterpik water flosser on gingival and epithelial tissue at multiple pressure settings; including the highest settings at nine and ten. One hundred and five subjects were assigned to one of three groups: 1) manual brushing and water flossing, 2) manual brushing and string 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 21)** The primary outcome measured was clinical attachment levels (CAL) as assessed from the cementoenamel junction and 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 affect gingival health or epithelial tissue.[54]

Figure 21: Use of the water flosser

The findings from Goyal et al. support those concluded in a 2015 literature review, which found no data to support that the Waterpik water flosser is detrimental to 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.[2]

Trauma to soft tissue was evaluated in a study at the University of Missouri Kansas City.[17] Investigators examined untreated, chronic periodontal pockets immediately following irrigation with the water flosser. Examination of specimens under a SEM showed no observable differences between the irrigated and nonirrigated specimens concerning the physical features and appearance of the epithelium. The investigators concluded that the Waterpik water flosser does not injure soft tissue.[17] This concurs with early work by Krajewski et al., who found less inflammation, better connective tissue organization, and an increased thickness in the keratin layer in individuals who used a water flosser twice daily compared to those who did not.[80]

Penetration and disruption of bacteria into the pocket have been studied by researchers.[17,18,40,41,44,45,49,51] Cobb et al. evaluated the reduction of pathogens with an SEM and found that areas treated with a Waterpik water flosser had significantly less bacteria, up to 6 mm compared to areas that had not been water flossed.[17] These results are supported by Drisko et al., who also found reduction of spirochetes up to 6 mm.[18] Others also have found water flossing over a course of three to six months reduces periodontal bacteria.[40,45,52] 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 Waterpik water flosser.[22,38,39,41,43,45,47,48,50] Cutler et al. found that the water flosser reduced probing depth by 0.4 mm in a two-week time span.[22] This is supported by Newman et al.,[38] Flemmig et al.,[39,43] and Chaves et

al.,[40] who found either small improvements or stable probing depths in periodontal maintenance patients who used the water flosser for a period of six months.

Bacteremia is a concern of dental professionals. The American Heart Association 2021 Scientific Statement on the Prevention of Viridian Group Streptococcus Infective Endocarditis emphasized the critical role of good oral health because any physical manipulation in the oral cavity has the potential for introducing microorganisms into the blood stream.[81] The incidence of bacteremia from using a water flosser has been studied on numerous occasions.[82-85] The research has shown the rate of bacteremia from water flossing is similar to traditional tooth brushing and string flossing.[81]

Table 2: Incidence of bacteremia for daily activities [86]

NOT ALL WATER FLOSSERS ARE CREATED EQUAL

Today many individuals purchase a water flosser online. With dozens of imitation models on the market it can be confusing for patients. Additionally, the quality of the brand may have a direct impact on the patient's experience. Poor quality can lead to negative outcomes such as reduced compliance and efficacy. The Waterpik™ water flosser stands apart from imitators with more than sixty years of engineering expertise and clinical research that has earned the prestigious ADA Seal of Acceptance for safety and efficacy. **(Figure 28)**

Researchers have extensively investigated the effectiveness of water flossing in comparison to other interdental methods, including traditional flossing, toothpicks, interdental brushes, and gum stimulators. Two recent studies compared the Waterpik water flosser paired with the precision tip to two other water flossers available on the market, which were paired with their respective novel tips. In both studies, the Waterpik water flosser paired with a precision tip consistently outperformed the water flossers paired with novel tips.[32,78]

Precision Tip Versus Air Microbubbles Tip (Figure 22) One hundred and five participants were randomly assigned to one of three groups, the Waterpik water flosser plus manual brush, water flosser infused with microbubbles of air plus manual toothbrush, or string floss plus manual toothbrush. The purpose of this study was to compare the efficacy of the water flosser with a precision tip to a water flosser infused with air microbubbles on the clinical signs of

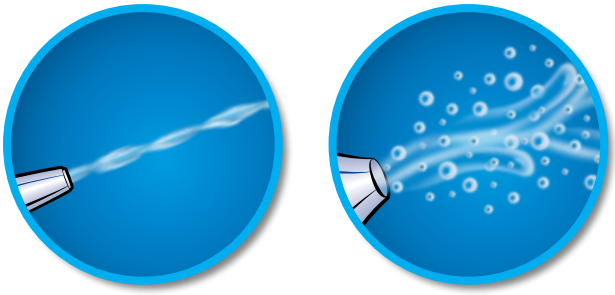

Figure 22: Precision tip versus air microbubbles tip

inflammation and plaque. From baseline to four-weeks the water flosser with a precision tip was 22% more effective at removing plaque, and 26% more effective at reducing bleeding and gingivitis.[32] The study concluded that a water flosser with air microbubbles does not provide an advantage over a traditional precision tip in improving oral health.

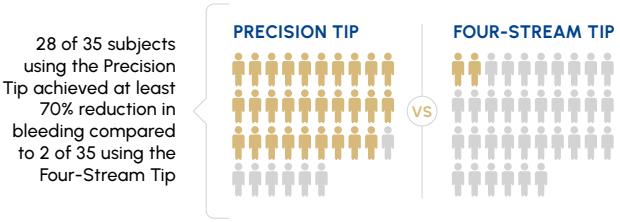

Figure 23: Precision tip versus a novel four stream tip

Precision Tip Versus Four Stream Tip (Figure 23) Lyle et al. conducted a four-week clinical trial with seventy participants to compare the effectiveness of a manual toothbrush plus a Waterpik water flosser with a precision tip to a manual toothbrush plus a power water flosser with a novel four-stream tip. The aim of the study was to determine which tip was better for the reduction of bleeding, gingivitis, and plaque. Twenty-eight of thirty-five subjects using the precision tip achieved at least 70% reduction in bleeding compared to two of thirty-five using the four-stream tip.[77] The results showed that a water flosser with precision tip is 26% more effective at removing plaque and 30% more effective at reducing bleeding on probing.[77] The study demonstrated that a novel four-stream tip does not provide an advantage over a traditional precision tip in improving oral health.[77]

HOW TO WATER FLOSS

Patients are more likely to be compliant with homecare when they feel comfortable and enjoy using a product. Data have indicated that people like and regularly use the water flosser.[37,39,40,43,87] Hoover and Robinson noted that subjects felt that using the water flosser was a pleasant experience and that their mouths felt cleaner.[37] Lainson et al. documented similar comments such as, "It stimulated the gums and made the teeth feel cleaner.[87]

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 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 and watch demonstration videos.
- 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 the arm up perpendicular to the torso **(Figure 24)**
- 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
- Place the tip at a 90-degree angle, and guide the tip along the gingival margin, pausing briefly between each tooth.
- Repeat the above step on the buccal and lingual surfaces of the maxillary and mandibular arch.
- For comfort, use warm water or room-temperature solutions.
- First time users should begin at the lowest pressure setting and gradually increase to a medium pressure as they become comfortable.
- Before removing the tip from the mouth, pause the flow of water or turn the unit off.

Click here to watch a short video on how to use the water flosser

Figure 24: Use of the water flosser

WHICH MODEL IS BEST?

When considering which model to recommend, lifestyle and personal preferences should be determining factors. The ADA Council on Scientific Affair has awarded the Waterpik™ brand 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 prevent and reduce gingivitis, when used as directed. Most of the water flosser models within the professional series have the ADA Seal of Acceptance.

Countertop water flossers are a great choice for first time users and patients who have had extensive restorative treatment. There are a variety of countertop models to meet the different needs of the user.

- Aquarius™ Professional Water Flosser **(Figure 25)** is a premium-design, high-performance, countertop water flosser.
- ION **(Figure 26)** is a countertop water flosser that offers the convenience of a cordless design. ION does not need to be plugged into an outlet while in use.
- Ultra Plus **(Figure 27)** is a countertop model that offers high performance.

Learn more about Waterpik™ water flossers.

Figure 25 Figure 26 Figure 27

Figure 28: ADA Seal of Acceptance

Combination water flossers are great for individuals who are looking for a convenient, customized oral care routine. They are also great for individuals who prefer less items on the counter.

- Sensonic Complete Care **(Figure 29)** offers patients a customized experience. This combination device features a traditional countertop water flosser paired with the Sensonic™ toothbrush.
- Sonic-Fusion™ **(Figure 30)** offers patients the ultimate convenience in homecare routine. It combines the power of sonic toothbrushing with the proven efficacy of water flossing to deliver a complete clean in one step.

Figure 29 Figure 30

Handheld water flossers are great for individuals who travel, have limited counter space, or are college students or caregivers. Waterproof handheld water flossers are also great for anyone who likes to do their oral care in the shower.

- Cordless Advanced 2.0 **(Figure 31)** is a waterproof handheld model with three pressure settings and features a four-hour rapid magnetic charging system with lithium-ion battery that will hold a charge for up to four weeks.

- Cordless Select **(Figure 32)** is a waterproof handheld model with two pressure settings and features a four-hour rapid magnetic charging system.

Figure 31 Figure 32

CLINICALLY TESTED SPECIALIZED TIPS

There are five different specialized tips that can be used with the Waterpik™ water flosser. The variety of tips allows for a customized approach depending on individual patient needs. **(Figure 33)** Each tip is designed with precise diameter opening to ensure comfortable, safe and effective use.

Precision Tip, Plaque Seeker™ Tip, or Orthodontic Tip

- The Precision Tip is for generalized cleaning.
- The Orthodontic Tip is designed to clean around traditional arch wires, brackets and fixed orthodontic appliances.
- The Plaque Seeker™ Tip is designed for use around implants and is also a great choice for patients with crowns, bridges or veneers.

Click here to see the use of the Precision Tip

Click here to see the use of the Orthodontic Tip

Click here to see the use of the Plaque Seeker™ Tip

Five Unique Tips for Individual Needs

Precision Tip: Good for general cleansing

Orthodontic Tip: Perfect for orthodontic appliances

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

Implant Denture Tip: Designed to reach underneath and around implant retained dentures

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

Figure 33

Here are instructions for how to use these three water flosser tips:

- 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 34)**
- After the unit has been turned on and water has begun pulsating, move the tip around the mouth in a linear fashion following the gingival margin, and pause briefly at the interproximal area.
- Make sure that all areas are irrigated from both the buccal and lingual regions. This allows adequate penetration of the solution into the gingival crevice or pocket.
- The Precision Tip, Plaque Seeker™ Tip, or Orthodontic Tip can be used with either a countertop or handheld water flosser.

The Pik Pocket™ Tip is a soft, rubber, site-specific tip. It is latex free and has been designed for low-pressure delivery. The use of the Pik Pocket™ Tip provides localized delivery to an individual site such as a deep pocket, furcation, implant, crown, and bridge. 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.[19] For pockets 7 mm or greater, depth of penetration is 64%.[19]

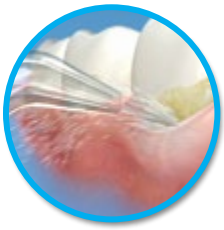

Figure 34: Placement of the Precision Tip

Figure 35: Turn the dial to the lowest setting to use the Pik Pocket™ Tip

Figure 36: Placement of the Pik Pocket™ Tip

Because this tip is site-specific, individuals will need to know exactly where in the mouth it should be used. Here are instructions for how to use the Pik Pocket™ Tip:

- Turn the unit to the lowest pressure setting. If the user forgets, the pressure will still be emitted at 20 psi, although failure to do this may shorten the life of the unit. **(Figure 35)**
- Gently place the tip slightly below the gingival margin. **(Figure 36)**
- Use a mirror to check that the tip is in the correct place.
- Briefly hold the tip in place before proceeding to another area.
- Although this tip will fit on a cordless model, it is best used on a countertop model so that the pressure can be turned down to 20 psi.
- This tip should be used with a countertop model and in conjunction with the Precision Tip, Orthodontic Tip or Plaque Seeker™ Tip.

Click here to see the use of the Pik Pocket™ Tip

The Implant Denture Tip was designed to help patients clean below full or partially retained dentures. The unique curved design reaches underneath and around implant supported dentures and bridges to remove plaque and food debris. Here are instructions for how to use the Implant Denture Tip:

- Place the tip on the lingual surface and move slowly around the denture. **(Figure 37)**
- If the patient knows where the implants are they can pause briefly in those locations.
- Repeat on the opposing arch.
- This tip works best with a countertop water flosser allowing for more precise tip placement.

Click here to see the use of the implant denture tip

Figure 37: Implant Denture Tip

WATER FOR WELLNESS

Water is the agent most commonly used in a water flosser. Water is effective because a water flosser's mechanism of action is related to pulsation and pressure, not the type of agent used. Most of the clinical studies done on water flossing have been conducted with water and found a body of evidence to support its use.[17,18, 22-26,29-31,35,37-40,43,47-50,61,80,87] Water also has several advantages, including that it is readily available, lacks side effects, is cost-effective, and is a natural resource.

ADDING MEDICAMENTS TO THE WATER FLOSSER

If desired, 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 the water flosser, except pure essential oils because they can reduce performance and will shorten the life of the product.

Essential oil mouthwash can be used because the essential oils are diluted. These rinses are readily available over the counter in name-brand and generic forms. Essential oil mouthwash has been studied as an irrigant.[41,45] It is important to note that the effectiveness of essential oil mouthrinse is based on studies using the rinse at full strength only. However, because water works, dilution is acceptable.

Chlorhexidine (CHX) has frequently been evaluated in water flosser studies.[36,40,42-44,46,50] 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 include the following:

- 0.02% = 5 parts water + 1-part CHX[46]
- 0.04% = 3 parts water + 1-part CHX[40,44]
- 0.06% = 1 part water + 1-part CHX[36,42,43,50]

Cleaning The Water Flosser When using anything other than water in the water flosser, 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.

Over time mineral deposits and other materials can collect in the water flosser, causing it to lose pressure and effectiveness. Water flossers should be cleaned every one to three months by running diluted vinegar through the unit. Tips and reservoirs can also be cleaned with warm soapy water or in the dishwasher. Regular cleaning will keep the water flosser performing at its best.

Click Here to Learn How to Clean a Waterpik™ Water Flosser

SUMMARY

To maintain or achieve periodontal health, interdental aids must be used in conjunction with toothbrushing to effectively remove plaque and reduce bleeding. Although dental floss has historically been considered the gold standard for interdental cleaning, it is important to note that many patients face challenges when it comes to flossing. Some patients may find it difficult, uncomfortable, or simply choose not to floss. Furthermore, it is worth mentioning that flossing is not the recommended interdental method for patients undergoing periodontal maintenance or those with dental implants. Therefore, alternative interdental aids should be explored and recommended to ensure effective plaque removal and reduction of bleeding in these patient populations.

Since its inception in 1962, the Waterpik water flosser has been evaluated in more than eighty scientific studies. Extensive clinical research has demonstrated that water flossing is a safe and effective way for patients to reduce clinical parameters and achieve optimal oral health. It has been shown to benefit a wide variety of patients with clinical considerations including orthodontic appliances, implants, diabetes, periodontal maintenance, and non-flossers. The wide array of water flosser models allows dental professionals to recommend a water flosser that will meet the unique needs and lifestyle of each individual patient.

Not all water flossers are created equal. To ensure patients get the clinical results you expect, recommend a water flosser that is backed by a name you trust with science to support the safety and efficacy of the product.

POST TEST FOR COURSE #24-36:

The Water Flosser: Harnessing the Power of Water to Achieve Optimal Oral Health

1. **There are more than _____ research studies that support the safety and efficacy of the Waterpik™ water flosser.**
   a. fifty
   b. sixty
   c. seventy
   d. eighty

2. **Water flossing is capable of reducing _____ .**
   a. plaque
   b. gingivitis
   c. bleeding
   d. probe depths
   e. all of the above

3. **The critical mechanism of action behind the Waterpik water flosser is _____ .**
   a. a steady stream of water
   b. air and water
   c. pulsation and pressure
   d. ultrasonic vibrations

4. **The Waterpik water flosser is capable of reducing bacteria up to _____ .**
   a. 2 mm
   b. 3 mm
   c. 6 mm
   d. 9 mm

5. **The Waterpik™ water flosser creates shear hydraulic forces that are capable of removing up to _____ of plaque from treated surfaces.**
   a. 39.9%
   b. 59.9%
   c. 79.9%
   d. 99.9%

6. **Compared to string floss, the Waterpik water flosser is up to _____ as effective for reducing whole mouth bleeding.**
   a. two times
   b. three times
   c. six times
   d. nine times

7. **String floss is not the recommended method for periodontal maintenance patients. This is due to floss's limited ability to remove plaque and reduce gingival inflammation.**
   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.

8. **_____ has emerged as one of the few self-care tools that has been tested on people with implants and found to be safe and effective for daily use.**
   a. Toothpicks
   b. String floss
   c. The Waterpik™ water flosser
   d. Rubber tip stimulator

9. **Water flossing around orthodontic appliances is how much more effective than using a string with a floss threader?**
   a. 3.76 times
   b. 5.83 times
   c. 7.76 times
   d. 9.83 times

10. **A sonic toothbrush combined with the Waterpik™ water flosser is up to _____ more effective at reducing gingivitis compared to manual brushing alone.**
    a. two times
    b. five times
    c. seven times
    d. nine times

11. **Lyle et al. found that twenty-eight out of thirty-five subjects who used the _____ experienced 70% or greater reduction in gingival bleeding.**
    a. novel four-stream tip
    b. precision tip
    c. air microbubbles tip
    d. implant denture tip

12. **Which statement is true regarding the safety of the water flossing?**
    a. It does not increase pocket depth
    b. It does not drive bacteria into the pocket
    c. The rate of bacteremia from water flossing is similar to that of traditional tooth brushing and string flossing.
    d. All of the above are true

13. **The Implant Denture Tip is designed for use from which surface?**
    a. Distal
    b. Buccal
    c. Lingual
    d. Occlusal

14. **Which tip should the Pik Pocket™ Tip be used in conjunction with.**
    a. The Precision Tip
    b. The Plaque Seeker Tip
    c. The Orthodontic Tip
    d. Any of the above

15. **Which solution should not be used in a water flosser due to its potential to shorten the life of the product?**
    a. Chlorhexidine
    b. Pure essential oils
    c. Cetylpyridinium Chloride
    d. Water

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