



# Oral Irrigator and Interdental Aids

A project submitted to

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Partial Fulfillment for The Bachelor of Dental Surgery

By:

**Mohammed Thaker**

Supervised By:

**Dr. Huda Akram Salim**

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# Dedication

To Whom I am proud of and I would like to thank them for everything: their love, encouragement and support.

\*My parents especially my Mother Who supported me with her prayers.

\*To all my family who always stood with me and helped me a lot.

\*My friends for the most beautiful years of joint university studies.

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## Introduction

Dental caries and periodontal disease are the two most common plaque associated oral diseases (Axelsson et al.,2004). Tooth brush and toothpaste are the most widely used oral hygiene measures(Claydon, 2008).

Dental plaque can be effectively removed only from facial and lingual surfaces and many people fail to remove interdental plaque due to difficulty of the bristles to reach inter dental spaces (Warren and Chater,1996; Christou et al., 1998). It is reported that only 30% of the total adult population used interdental aids mainly floss (Kressin et al., 2003; Segelnick,2004).

One of the limiting factor for using interdental aids is that it is time consuming and requires for an individual to develop skill to use it correctly (Segelnick,2004; Asadoorian and Locker,2006).

To overcome this limitation, Water flosser is a recent development in interdental aids for regular home use which claims to be relatively easy to use. Water flosser functions through pulsation and pressure action. These two actions help in disruption of plaque and removal of loosely lodged debris. It works in the pressure range of 50–90 psi. The handle has to be held at a 90-degree angle to the tooth and irrigate the tissues at an appropriate pressure setting (Lyle,2012).

## Review

The first personal commercially available dental water-jet flosser with acceptable water pressure was introduced in the 1960s (Lobene,1971). Water flossers are safe; there is no evidence of unfavorable effects on the attachment or junctional epithelium (Jolkovsky,2015). These devices have also demonstrated effectiveness at removing bacteria and reducing the signs of inflammation with a significant reduction in gingivitis (Lyle,2016).

Recently, some commercial brands of flossers received the American Dental Association (ADA) Seal of Acceptance for their safety and efficacy for removing plaque and for helping to prevent and reduce gingivitis (Lyle,2012).

Oral irrigator devices can also be used with antimicrobial agents. The oral irrigator facilitates the removal of food debris in posterior areas, especially in cases of fixed bridges or orthodontic appliances, when the proper use of interdental cleaning devices is difficult (Abdullah et.al., 2018).

Patients who added an oral irrigator to an oscillating brush routine were 33% more effective at removing plaque biofilm, 37% more effective at reducing bleeding, and 35% more effective at reducing gingivitis versus those who only used the oscillating brush. A recent entry to the water flosser market features a sonic toothbrush with a built-in water flossing. This allows patients to brush and water floss with one device. When used for 2 minutes of power brushing followed by 1 minute of water flossing, this device was up to twice as effective as traditional brushing and flossing for reducing plaque biofilm, gingival bleeding, and inflammation(Jahn, 2024)

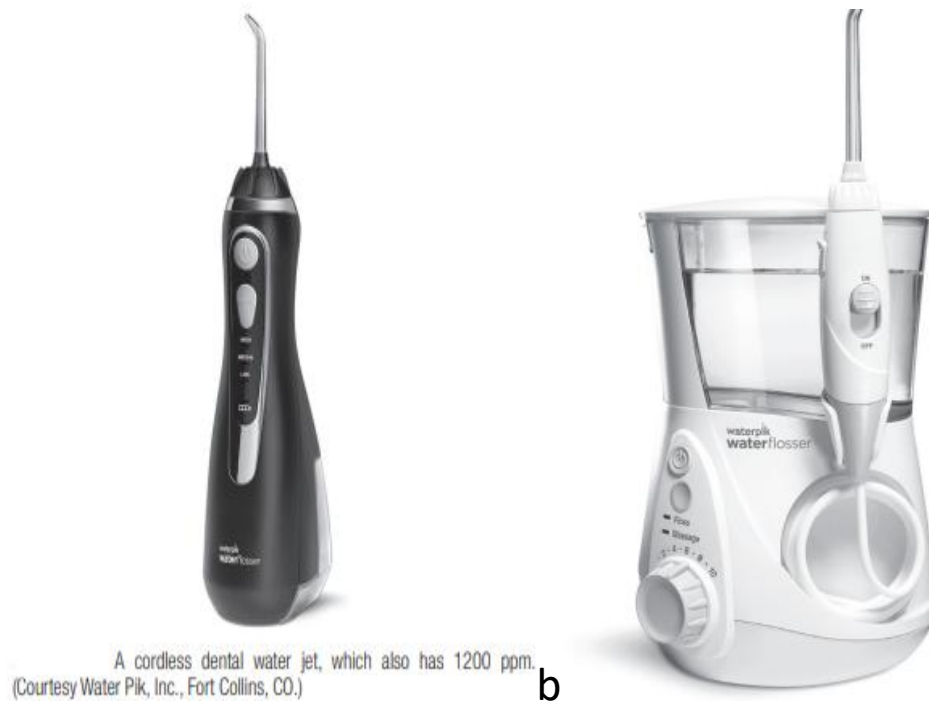
## TYPES AND BRANDS OF ORAL IRRIGATOR

Waterpik was the most researched brand, used in 139 studies and compared to other brands in 17 studies. Other pulsating and non-pulsating, self-contained, and faucet- attached devices were also studied. Faucet-attached irrigators generated higher forces and were difficult to attach, causing some participants to cease irrigation (Lainson et al.,1972; Lugassy et al.,1971).

All irrigator types could force particulate matter into tissues (O'Leary et al.,1970). Pulsating devices were more effective in reducing inflammation because of the decompression phase (Bhaskar et al.,1971). Faucet- attached and self-contained units had similar clinical efficacy. Specialized devices produced ozonated water (Kent Ozone Aquolab, PURECARE) and magnetized water (Hydro Floss)(Lainson et al.,1970; Oshrain et al.,1987). Figure (1-1) and (1-2) show types of oral irrigators.



**Figure (1-1) Oral irrigator:**  
(Rosema et.al., 2011)



**Figure (1-2): Types of Oral irrigators: (Jahn, 2024).**

## Classification of Water Flosser

Many types of oral irrigators are commercially available; however, research data from one product brand cannot be extrapolated to other brands, because different brands may have different pressure settings and pulsation rates. A best practice is to determine if the product carries the American Dental Association (ADA) Seal of Acceptance, which indicates that the product has been evaluated for safety and efficacy (Jahn, 2024).

WFs operate based on a combination of pressure and pulsation mechanisms. The device typically consists of a reservoir for water and a hand-held nozzle. As the user directs the nozzle between their teeth and along the gumline, a pressurized stream of water is expelled. WFs may be traditional, power-driven, clinical grade, portable, or adaptive in nature. (Altalhi et al.,2023). Table (1-1) illustrate the classification system of oral irrigators.

**Table (1-1): Classification system of Water floss**

Table 1. Novel classification system for WFs based on their application.

Classification	Type of water flosser (WFs)	Description
Class 1	Traditional	These are standard WFs with a water reservoir and a nozzle for directing water between teeth and along the gumline.
Class 2	Power-driven	This category includes electric or power-driven WFs that provide additional features such as adjustable pressure settings and pulsating water streams for enhanced cleaning.
Class 3	Clinical grade	Specifically designed for professional dental use, clinical-grade WFs may have advanced features for precise control and comprehensive cleaning.
Class 4	Portable	Compact and travel-friendly, portable WFs are designed for on-the-go use, often powered by batteries or USB charging.
Class 5	Adaptive	Advanced models may incorporate smart technology, adapting to individual oral care needs, providing real-time feedback, and optimizing cleaning routines.



## **Mechanism of Action of Oral Irrigator**

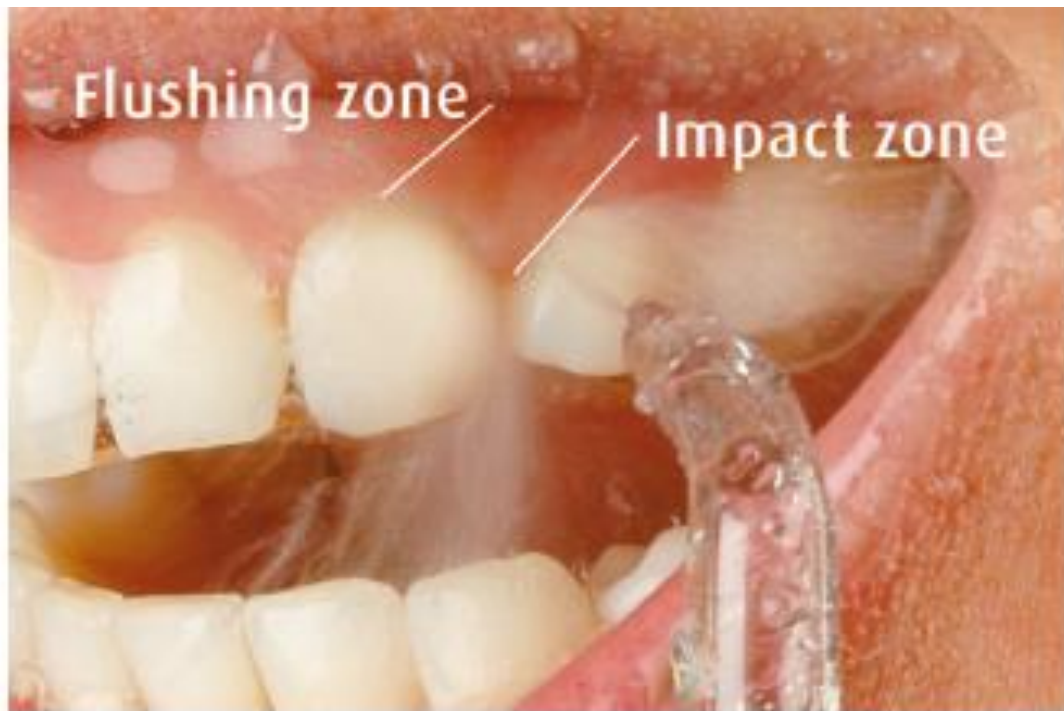
The mechanism of action of irrigation is through pulsation and pressure (Bhaskaret al.,1971; Bhaskaret al.,1969; Selting et al., 1972).

Pulsation creates a decompression phase that allows the water or solution to penetrate subgingivally. It is followed by a compression phase that expels bacteria and debris from the pocket. Physiologically, pulsation, along with pressure and water velocity, creates shear hydraulic forces that are capable of removing supragingival plaque and flushing out subgingival bacteria and other debris from treated areas, two zones of hydrokinetic activity are created—an impact zone where the solution contacts the gingival margin, and a flushing zone where the irrigant reaches subgingivally Figure (1-3) (Gorur et al,2009;Ng and Lim, 2019).

Clinical efficacy of home irrigation has been found for units that pulsate from 1200 to 1400 pulses per minute set at a minimum of 60 psi(Jahn, 2010). The oral irrigator is safe to use at higher pressure settings(Goyalet al.,2018).

In addition to their ability to flush away loosely adherent plaque, remove bacteria cells, and interfere with plaque maturation, the use of oral irrigators was shown to reduce inflammation by reducing pro-inflammatory cytokines (IL-1 $\beta$  and PGE2) in the gingival crevicular fluid of patients with localized mild to moderate periodontitis and diabetics. Indeed, by altering specific host-microbial interactions in the subgingival environment, pulsations from oral irrigators may reduce inflammation independent of plaque removal (Ng and Lim, 2019).

Attached gingiva can withstand pressure up to 160 psi for 30 s without irreversible damage, leading Bhaskar et al. to recommend that 90 psi is acceptable on undamaged tissue and 50–70 psi suitable for inflamed or ulcerated tissue. A position paper by the American Academy of Periodontology supports the use of supragingival irrigation at forces of 80–90 psi, also commenting that oral irrigation poses no safety hazard as bacteremia levels are similar to toothbrushing, flossing, scaling, and chewing. Information concerning higher-risk patients who require prophylaxis prior to periodontal therapy is unavailable (Ng and Lim, 2019).



**Figure (1-3): Zones of Oral Irrigators (Rajbhoj and Anjankar, 2019).**

### **Tips of Oral Irrigators**

A variety of tips can be used with an oral irrigator. The traditional jet tip is placed supragingivally (slightly above the gingival margin) at a 90-degree angle. Data indicate this results in an average pocket penetration of 50% (Eakle et al., 1986). Figure (1-4).



**Figure (1-4): Types of tips. (Jahn, 2024).**

A soft, site-specific subgingival tip (Pik Pocket subgingival irrigation tip, Water Pik, Inc., Fort Collins, CO) is placed slightly subgingivally and it penetrates to about 90% of the depth of pockets that are 6 mm or less and

64% of pockets that are 7 mm or greater(Braun and Ciano,1992). Figure (1-5).



**Figure (1-5): Types of tips. (Jahn, 2024).**

Tips that are placed supragingivally are recommended for full-mouth irrigation or cleansing. These tips include a traditional jet tip along with jet tips of this configuration that have been enhanced with bristles or filaments to assist in biofilm removal(Rosemaet al.,2011; Sharmaet al.,2008). Figure (1-6) and (1-7).

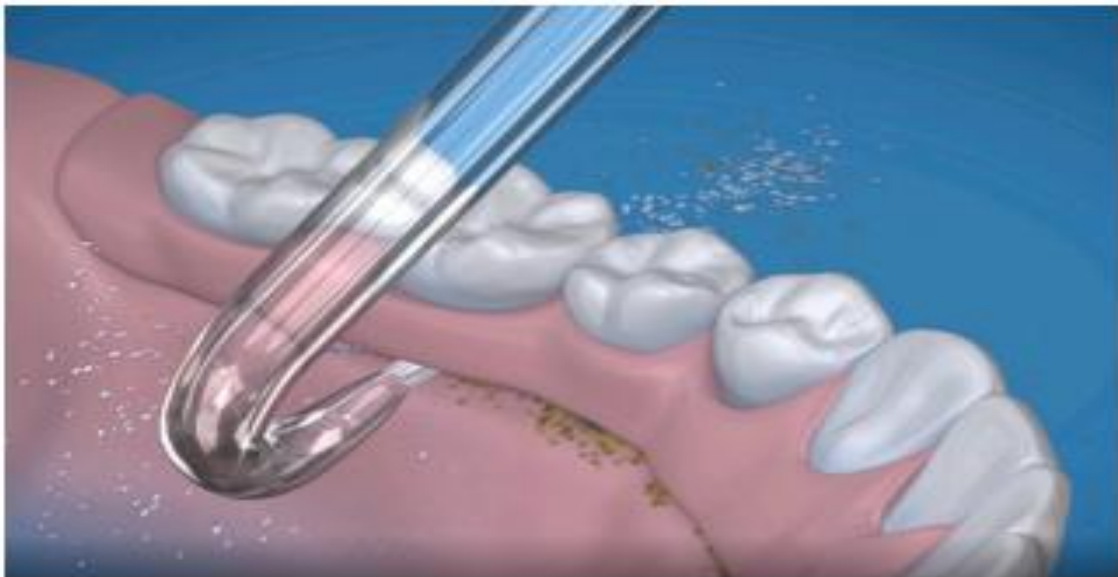


**Figure (1-6): Types of tips. (Jahn, 2024).**



**Figure (1-7): Types of tips.**  
**(Jahn, 2024).**

The subgingival tip is recommended after full-mouth cleaning for localized irrigation of a specific site that is difficult to access, such as a deep pocket, a furcation, an implant, or a crown and bridge. A new tip with a candy cane design is available to help patients clean under implant-retained dentures (Jahn, 2024). Figure (1-8).



**Figure (1-8): Types of tips.** (Jahn, 2024).

## **WFs versus traditional dental floss**

A WF was found to be more effective than dental floss for interdental care. The mean percentage reduction of the gingival index, plaque index, and bleeding on probing scores was higher in the group using a WF and toothbrushing compared to the group using only toothbrushing and the group using dental floss and toothbrushing(Akram, 2015).

Tooth brushing with the use of Waterpik Flosser once daily with plain water, is more effective than brushing and flossing, Waterpik is an effective alternative to dental floss. Incorporating both WFs and traditional flossing into one's oral care routine can provide a comprehensive approach to plaque removal and gingival health, ultimately contributing to improved overall oral hygiene. A combined approach ensures a more thorough removal of interdental plaque, as WFs effectively reach areas that traditional floss may miss (Sanz et al.,2020;Shibley et al.,2001)

Several studies exist supporting the efficacy of oral irrigators as compared with other interdental devices. Most of the studies were generated using commercially available products like Waterpik and Philips Sonicare Airfloss. Most of the studies demonstrated that oral irrigators may be more effective than dental floss or interdental brushes in reducing bleeding, plaque, or probing depths (Ng and Lim, 2019).

## **ADVANTAGES OF ORAL IRRIGATOR**

In vitro studies consistently show efficacy in OIs dislodging biofilm from dental surfaces and restorations, though these outcomes may not replicate clinical experiences. Observational and descriptive research indicates that oral irrigation contributes to lower plaque levels, suggesting a beneficial role in oral hygiene practices (Costa et al.,2020; Rüdiger et al.,1999). Listerine subgingival irrigation reduced bacteremia after instrumentation in periodontitis (Fine et al.,1996).

Biofilm reduction with chlorhexidine and ozonated water irrigation. Improvements occurred in individuals with mental disabilities (Tatuskar et al.,2023), pregnant participants (Tecco et al.,2022), orthodontic

patients (Dhingra and Vandana 2011; Sandra et al., 1986), individuals with dental implants (Felo et al.,1997), and intermaxillary fixation patients (Aijima and Yamashita, 2023; Soltanianzadeh,2020).

Reduction in gingival bleeding scores by adjunctive oral water irrigation in patients with gingivitis (Allen,2019; AlMoharib et al.,2023; Edlund et al.,2023; Kotsakis et al.,2018; Volman et al.,2021).

OIs' safety and effectiveness in delivering solutions and removing smear layers in root canal systems, suggesting potential applications beyond traditional oral hygiene uses (Hemalatha et al.,2022; Shalan and Al-huwaizi,2017; Shalan et al.,2018).

## **DISADVANTAGES OF ORAL IRRIGATOR**

There is little to no effect on the composition of subgingival plaque and reducing periodontal pockets(Sanders et al.,1986; Shiloah and Hovious,1993). Furthermore, concerns about bacterial colonization and the risk of cross-contamination have been raised during regular daily use of power-driven WFs(Bertlet et al.,2022). Dental irrigators can cause transient bacteremia, with incidence correlated to oral hygiene and periodontal disease. This may be an important consideration for people who are at risk of endocarditis(Felix et al.,1971).

## **Interdental Aids**

None of the tooth brushing methods is efficient in eliminating the interproximal dental plaque. The interproximal cleaning should be an inseparable part of the daily plaque removal routine. Dental floss, interdental brushes, single tufted brushes, wooden/ plastic interdental stimulators/tips, and also oral irrigators are devices to eliminate dental plaque from interdental sites (Chapple et al.,2015).

The interdental gingiva fills the embrasure between two teeth apical to their contact point. This is a 'sheltered' area that is difficult to access when teeth are in their normal positions. In populations that use toothbrushes, the interproximal surfaces of the molars and premolars are the predominant sites of residual plaque. The removal of plaque from these surfaces remains a valid objective because in patients susceptible to periodontal disease, gingivitis and periodontitis are usually more pronounced in this interdental area than on oral or facial aspects (Löe,1979).

## Interdental brushes

Interdental brushes were introduced in the 1960s as an alternative to wood sticks. The interdental brush consists of soft nylon filaments twisted into a fine stainless-steel wire (Hoenderdoset al., 2008). Appropriate interdental brushes are currently available for the smallest to the largest interdental space which ranges from 1.9 to 14 mm in diameter. Interdental brushes have the added advantage of serving as vehicles for the local application of antibacterial agents or desensitizing agents to exposed sensitive root areas. Interdental brushes are frequently recommended by dental professionals to patients with sufficient space between their teeth (Weijden, 2012).

Interdental brushes are manufactured in different sizes and forms. The most common forms are cylindrical or conical/ tapered (like a Christmas tree). The length of the bristles in cross - section should be tailored to the interdental space (Abdullah et.al., 2018). Figure (1-9).

The superiority of interdental brushes is thought to be due to higher efficacy of plaque removal and high patient acceptance, as well as ease of use. Thus, it is clear that the use of interdental brushes as an adjunct provides a clinical benefit over brushing alone (Weijden, 2012).

There are several factors to consider when choosing an interdental brush which may affect its efficacy. The first is that size matters to determine the best-fitting interdental brush for proximal sites, another factor to consider is the geometry of the interdental brush. Straight interdental brushes may be more effective in interproximal plaque removal than angled interdental brushes with a long handle (Ng and Lim, 2019).





**Figure (1-9): Interdental brush: (Abdullah et.al., 2018).**

## **Dental Floss**

According to American Dental Association, 80% of the plaque can be removed by dental floss usage (Yetkin, 2016). Reports of the benefits of flossing date back to the early 19<sup>th</sup> century, when it was believed that irritating matter between teeth was the source of dental disease. Over the years, it has been generally accepted that dental floss has a positive effect on removing plaque (Abdullah et.al., 2018).

Routine use of dental floss is low, ranging between 10% and 30% among adults. The low compliance observed among adults could be because flossing is a technically challenging task. Studies showed that few individuals floss correctly and patients find flossing difficult, especially in areas with tight contact points. Consequently, it was found that unsupervised flossing does not result in substantial reductions in gingival inflammation (Ng and Lim, 2019)

It has been generally accepted that dental floss has a positive effect on removing plaque (Axelsson et al., 2004). Even subgingival plaque can be removed, since dental floss can be introduced 2 to 3.5 mm below the tip of the papilla. Dental floss disrupts and removes some interproximal plaque, it has been thought that flossing should reduce gingival inflammation (Waerhaug, 1981). Figure (1-10).

Flossing as the sole form of oral hygiene has been shown to be effective in preventing the development of gingival inflammation and reducing the level of plaque (Barendregt et al.,2002).

Professional flossing was shown to be effective in reducing interproximal caries risk; however, this beneficial effect was lost when flossing was self-performed. For patients lacking dexterity or compliance, floss holders represent a potential alternative. Further, floss holders are significantly more effective in helping patients establish a long-term flossing habit, with floss holder users more likely to floss than hand-flossers. Dental floss as an adjunct to toothbrushing on plaque and parameters of gingival inflammation, in adults with periodontal disease. (Ng and Lim, 2019).

The automatic dental flosses might be recommended to the subjects having trouble in removing plaque in posterior regions. The studies have revealed the success of the automatic dental flosses in removing interproximal dental plaque in anterior, premolar, and molar teeth [21], and suggested that their usage might be preferred to the manual dental flosses (Yetkin, 2016).

The misused interdental tools lead to inefficiency regarding plaque removal in addition to the gingival injuries and recessions. The interproximal abrasions in cemento-enamel junction are generally located to the posterior lingual and interproximal surfaces and are related to the long-term misuse (like a saw) of the dental floss. The patients should be informed and warned against this hard tissue injury (Yetkin, 2016).

Dental floss is available in various forms like: Waxed, non-waxed, Orthodontics floss with holder, Material- silk, nylon, expanded Polytetrafluoroethylene, Twisted, non-twisted, Thick, thin, Bonded, non-bonded (Abdullah et.al., 2018; Rajbhoj and Anjankar, 2019).



Figure 3: Various types of Dental Floss.

**Figure (1-10): Dental floss: (Abdullah et.al., 2018).**

### **Tooth Pick**

Toothpicks are one of the earliest and most persistent “tools” used to “pick teeth.” The toothpick may date back to the days of the cave people, who probably used sticks to pick food from between their teeth. Originally, dental wood-sticks were advocated by dental professionals as ‘gum massagers’ used to massage inflamed gingival tissue in the interdental areas to reduce inflammation and encourage keratinization of the gingival tissue (Weijden, 2012).

Wood-sticks are designed to allow the mechanical removal of plaque from interdental surfaces. For open interdental spaces, common among adults, wood-sticks seem most appropriate. Wood-sticks can only be used effectively where sufficient interdental space is available. Wood-sticks have the advantage of being easy to use and can be used throughout the day without the need of a bathroom or mirror (Galgut, 1991).

Similar to interdental brushes, wood-sticks are able to remove plaque up to 2–3 mm subgingivally by depressing the papilla. They fit best into interdental spaces with a triangular cross-section and should not be confused with toothpicks. Toothpicks are round, allowing only point contact with the tooth surface and, thus, are more suited for removing food debris after a meal (Ng and Lim, 2019).

The round toothpick is too thick and too blunt to reach the lingual half of the tooth when trying to angle it, while the curved surface of the toothpick provides only point contact with the tooth surface. Wood sticks

are inserted interdentally with the base of the triangle resting on the gingival side. The tip should point occlusally or incisally and the triangles against the adjacent tooth surfaces. The tapered form makes it possible for the patient to angle the wood-stick interdentally and even clean the lingually localized interdental surfaces(Weijden, 2012). Figure (1-11).

Wood sticks may specifically remove subgingival plaque that is not visible; hence, gingival inflammation parameters may improve while minimally affecting the plaque index. The advantages of toothpicks/wood-sticks include ease of use and convenience. They may be more acceptable to older patients, especially those who routinely use toothpicks to remove food debris after eating (Ng and Lim, 2019).



**Figure (1-11): Tooth Pick: (Abdullah et.al., 2018).**

## Conclusion:

Interdental cleaning aids play a vital role in optimizing gingival health and preventing oral disease. The biphasic mode of action of oral irrigators may result in qualitative changes in subgingival plaque. They may, thus, reduce gingival inflammation, although overall plaque levels as measured supra-gingivally may appear unaffected. The water irrigator and tooth brushing can be used to clean dental plaque accumulation on teeth with fixed appliances (braces). But when both of them compared in the effectiveness, water irrigator was significantly showed better results.

The appropriate interproximal cleaning aid is determined by the ease of use, the size of the interproximal space, the individual's acceptability, dexterity, and motivation. Thus, the dentist can make a recommendation based on the unique characteristics of each patient.

Future research is needed to further confirm the effectiveness of water jet flossing and to better understand its specific benefits for orthodontic patients, including its long-term impact on oral health, potential to enhance patient comfort during treatment, and its influence on patient compliance with oral hygiene practices.

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