

Effectiveness of Water Flossers in Orthodontic Treatment: A Systematic Review

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Abstract

Background: Maintaining good oral hygiene with orthodontic appliances can be challenging, leading to plaque accumulation and complications. Traditional oral hygiene tools have limitations, and water flossers have been proposed as an effective solution. This review aims to examine the effectiveness of water flossers in orthodontic treatment by analyzing relevant studies. **Methods:** A systematic literature search was conducted using PubMed, Scopus, and Embase databases following PRISMA guidelines. Inclusion criteria included observational studies reporting data on the benefits of water flossers in orthodontic treatment, focusing on outcomes such as plaque formation, gingival inflammation, and periodontal diseases. Exclusion criteria included non-observational studies, meta-analyses, systematic reviews, studies in languages other than English, and studies published before 1990. Study selection and screening were performed based on relevance and eligibility. **Results:** The initial search yielded 740 papers, which were narrowed down through screening and exclusion criteria. Ultimately, nine comparative studies were included in the review. The included studies encompassed multiple designs and sample sizes. Data extraction included information on the study year, study design, sample size, outcome assessed, intervention details (type of water flosser used, treatment duration), and conclusions related to the effectiveness of water flossers in orthodontic treatment. **Conclusion:** The review suggests that water flossers can be a valuable addition to the oral hygiene routine of orthodontic patients. The studies reviewed demonstrated the effectiveness of water flossers in plaque control, reducing gingival inflammation, and minimizing bleeding compared to traditional tools like interdental brushes and string floss. However, the evidence base is still limited, and further research is needed to strengthen the findings and explore the long-term effects of water flosser use in orthodontic treatment.

Keywords: Water flossers, orthodontics, oral irrigation, water jet.

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INTRODUCTION

It is generally acknowledged that using orthodontic equipment makes it harder to keep up with appropriate dental hygiene. Plaque buildup, gingivitis, and other issues might result from oral hygiene difficulties brought on by fixed orthodontic equipment, such as braces. Sustaining regular, appropriate, and proper dental hygiene is the most crucial factor in preserving the health of periodontal tissues, halting illness, and sustaining health. The first step in preventing oral illnesses is frequent, efficient plaque removal using a toothbrush and toothpaste. Despite being adequate for eliminating dental biofilm from the buccal, lingual,

palatal, and occlusal surfaces of the teeth, studies have revealed that the toothbrush is ineffective for cleaning the interdental space. Dental irrigators, commonly referred to as water flossers, are being investigated more and more for their ability to maintain dental hygiene while receiving orthodontic treatment [1]. With the use of typical oral hygiene products like toothbrushes and dental floss, orthodontic appliances generate regions that are difficult to reach. It is typical for plaque to build up around brackets, bands, and wires; this may cause gingival irritation, enamel demineralization, and periodontal disorders [2]. During orthodontic therapy, the makeup of oral bacteria also changes, with a rise in cariogenic and periodontopathic bacteria. Even when the

orthodontic devices are removed, these modifications may continue to affect the oral flora. Stalling plaque surrounding orthodontic equipment contributes to decalcification in addition to its impact on the periodontium. The teeth may develop cavitation as a result, leaving behind ugly, permanent white or brown stains [3].

For orthodontic patients who can use a variety of instruments to keep their teeth clean, good oral hygiene is crucial. They include common toothbrushes (manual or electric), dental floss, interdental brushes, and specialized orthodontic brushes. Another option is the Water Flosser, which was introduced to the market in the 1960s and has a small tube-shaped tip that makes it easier to clean teeth while simultaneously targeting soft tissues, providing a more thorough clean in addition to more effectively removing plaque and dirt.

Orthodontic patients employ a variety of tools to maintain good oral hygiene, including manual or electric toothbrushes, dental floss, interdental brushes, and specialized orthodontic brushes. The Water flossers, which feature a little tube-shaped tip, have been available on the market since the 1960s. It has been shown that water flossers, which use a pulsing stream of water to clean the teeth and soft tissues, are an efficient way to remove dirt and plaque. They may access places that are difficult to clean with conventional equipment, such as the interdental gaps surrounding orthodontic devices [4]. Water flossers compress and decompress gingival tissue, enabling the water to efficiently remove plaque, germs, and debris from subgingival and interdental regions. A water flosser with an orthodontic tip may help patients using fixed orthodontic equipment better manage plaque during a four-week period, according to the available research. However, for orthodontic patients, the average length of their therapy is substantially longer—about 24.9 months. For these patients, finding the optimal regimen that is quick, simple, and successful is extremely crucial. In light of this, we proposed that water flossers would have high ongoing patient motivation, simple use, and no space restrictions [5].

This study aims to investigate the efficacy of water flossers in orthodontic therapy, taking into account their capacity to eliminate plaque, lessen gingival inflammation, and address other oral health issues related to fixed orthodontic equipment. The usefulness of water flossers in orthodontic therapy is also highlighted in this study, along with any gaps in the research. This study aims to add to the body of knowledge by synthesizing the existing research and to shed light on the possible advantages of including water flossers in the daily oral hygiene regimen of orthodontic patients.

METHODS

This systematic review adhered to the protocol standards of Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) [6]. PRISMA is

a set of guidelines for reporting systematic reviews and meta-analyses that are supported by evidence. This database of guidelines backed by research is especially useful for people performing studies on subjects other than therapies, i.e. those looking for underlying reasons or making diagnosis [7]. This systematic review's protocol is registered in the PROSPERO database.

FORMULATING THE RESEARCH QUESTION:

The research question guiding this review was: "What is the effectiveness of use of water flossers in patients undergoing orthodontic treatment?"

SEARCH STRATEGY:

The study involved a systematic literature assessment of effectiveness of water flossers in orthodontic treatment using the PubMed, Scopus and Embase. An electronic search was employed to find the published articles from inception of time to 02 June 2023, which reported effectiveness of water flossers in orthodontic treatment through the following databases: PubMed/MEDLINE, Scopus and Embase. We employed the following search terms: 'water flossers', 'oral irrigation', and 'orthodontic treatment'. We also took into account the distinctions between regulated vocabulary and syntactic rules. In addition, Boolean operators (OR/AND) and asterisk (*) were used to find available related evidence as follows: "Water flossers*" OR "Oral irrigator*" OR "Oral irrigation*" OR "Waterjet*" OR "Water jet*" AND "Effectiveness" OR "Efficacy OR Efficiency *" OR "Outcome *" OR "Impact*" AND "Orthodontic" OR "Braces" OR "Aligners" OR "Orthodontics".

Inclusion Criteria:

Studies were included based on the following criteria:

- Articles should be original comparative studies.
- Studies should report data on at least these two variables: water flossers and orthodontic treatment.
- Studies should be written in English.
- Studies should report any outcomes of water flossers like effect on plaque formation, gingival inflammation, enamel demineralization, and periodontal diseases
- Studies should be published after 1990.

Exclusion Criteria:

Studies were excluded if they are a case report, letter to the editor, conference articles, commentary, systematic review, meta-analysis or viewpoints. Studies were also excluded if they were written in a non-English language, published before 1990 or were performed on non-human populations.

STUDY SELECTION AND SCREENING:

Titles and abstracts were screened to check for duplicates and to determine their relevance to the research question. The screened articles were then passed through a full-text screening that was performed to check

for eligibility, relevance, and outcomes. Ineligible studies were removed, and the remaining studies were included in the review.

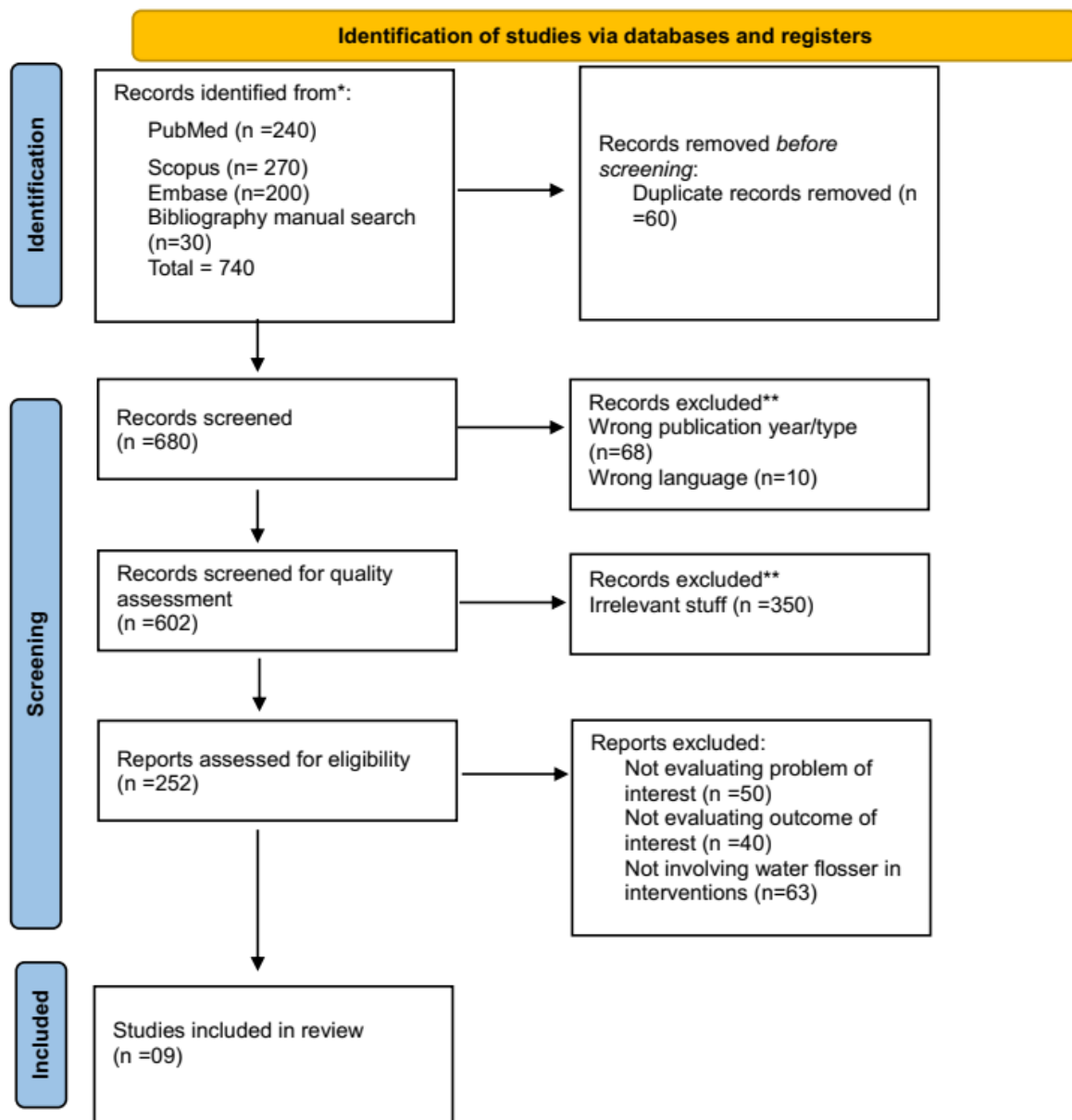


Figure 1: PRISMA Flowchart

DATA EXTRACTION AND ANALYSIS:

From the chosen studies, pertinent information was systematically retrieved. The data that were extracted included the author name, year of study, study design, sample size, outcome assessed, intervention information (such as the type of water flosser utilized, the length of treatment, and conclusions relating to the usefulness of water flossers in orthodontic treatments). To detect trends and conclusions that were consistent throughout the research, the data were analyzed, summarized and tabulated.

QUALITY ASSESSMENT:

The quality and risk of bias of the included studies were evaluated using the Cochrane Risk of Bias Tool for Randomized controlled trials (RCTs) [8]. For other comparative studies, the following Bondemark grading system [9] was used.

Grade A—High value of evidence (All criteria should be met):

- Randomized clinical study or a prospective study with a well-defined control group
- Defined diagnosis and endpoints

- Diagnostic reliability tests and reproducibility tests described
- Blinded outcome assessment

Grade B—Moderate value of evidence (All criteria should be met):

- Cohort study or retrospective case series with defined control or reference group
- Defined diagnosis and endpoints
- Diagnostic reliability tests and reproducibility tests described

Grade C—Low value of evidence (One or more of the conditions below):

- Large attrition
- Unclear diagnosis and endpoints
- Poorly defined patient material

The quality assessment helped determine the overall strength of the evidence and the reliability of the study findings.

DATA SYNTHESIS AND REPORTING:

The findings from the included studies were synthesized and reported in a descriptive manner. The

limitations of the included studies were discussed, and gaps in the existing literature were identified. Recommendations for future research or implications for orthodontic practice were provided.

RESULTS

As illustrated in Figure 1, the initial literature search turned over 740 papers. Due to redundancy in multiple search databases, 60 studies were removed. Ten research were disqualified because they were written in languages other than English. Due to being published before 1990 or having an improper study design, such as a meta-analysis, systematic review, etc., 68 publications were omitted from the review. The relevance of 602 article titles and abstracts was evaluated, and the complete context of those articles was obtained for additional research. Studies that did not meet the inclusion criteria were excluded, including those that did not contain necessary interventions like water flossers, studies conducted before 1990, and others. The systematic review that was ultimately conducted comprised a total of 9 papers.

| Sr. No | Author, Year | Study Design | Title | Participants | Outcome Assessed | Intervention Used | Conclusion |
|--------|--|--------------|--|--|--|---|---|
| 1 | Daniel Tyler <i>et al.</i> , [10] (2023) | RCT | Effectiveness of Waterpik® for oral hygiene maintenance in orthodontic fixed appliance patients: A randomized controlled trial | 39 participants aged 10–20 years being treated with upper and lower fixed orthodontic appliances | Plaque level, using the Orthodontic Modification of Plaque Index (OMPI) and the Plaque Index (PI) | Participants were randomly assigned to either the intervention group (Water flosser + Manual tooth brush) or the control group (Manual tooth brush) | This study did not find evidence to support the claim of benefit of using a water flosser in addition to a manual toothbrush for patients wearing fixed orthodontic appliances |
| 2 | Esma Şahin <i>et al.</i> , (2022) [11] | RCT | Human Randomized Controlled Trial Clinical and Biochemical Evaluation Oral Irrigator Effectiveness in Patients Under Orthodontic Treatment | 30 patients | Effectiveness of oral irrigators (OIs) compared to interdental brushes (IBs) in interdental cleaning of orthodontic patients | The patients were divided into two equal groups: those who used oral irrigator (water flosser) in addition to manual brushing (OI group) and those who used interdental brush in addition to manual brushing (IB group) | In the OI-group compared to the IB-group, the gingival index, bleeding on probing values at the 8th week, and plaque index values at the 2nd, 4th, and 8th weeks were all shown to be significantly lower |

| Sr. No | Author, Year | Study Design | Title | Participants | Outcome Assessed | Intervention Used | Conclusion |
|--------|---|-------------------------------------|---|---|---|--|---|
| 3 | C. Ram Goyal <i>et al.</i> , (2013) [12] | RCT | Evaluation of the plaque removal efficacy of a water flosser compared to string floss in adults after a single use | 70 adult subjects | Effectiveness of a water flosser in removing plaque as compared to string floss after a single use | Two groups were created: one using waxed string floss and the other using a manual toothbrush (WF and SF respectively) | Plaque removal from tooth surfaces is substantially more efficient with the Waterpik Water Flosser and manual toothbrush than with a manual brush and string floss |
| 4 | Naresh C Sharma <i>et al.</i> , (2008) [13] | RCT | Effect of a dental water jet with orthodontic tip on plaque and bleeding in adolescent patients with fixed orthodontic appliances | 106 subjects | Reduction of plaque and bleeding in adolescent patients with fixed orthodontic appliances | The subjects were randomly assigned to 1 of 3 treatment groups: group 1, once-daily irrigation with a dental water jet and orthodontic jet tip plus a manual toothbrush; group 2, once-daily flossing (FL) plus a manual toothbrush; and group 3, manual toothbrush (MT) only. | Water flosser in conjunction with a manual toothbrush (DWJ) was the most successful method for reducing plaque |
| 5 | J G Burch <i>et al.</i> , (2019) [14] | Mixed design analysis of covariance | A two-month study of the effects of oral irrigation and automatic toothbrush use in an adult orthodontic population with fixed appliances | 47 adult orthodontic patients with fixed orthodontic appliances | Oral health status of the patients, using plaque index, gingival index, probe depth, and BAP (bleeding after probing) index | There were three study groups: (1) oral irrigation with an automatic toothbrush, (16 participants); (2) oral irrigation with a manual toothbrush, (16 participants); and (3) a control group, (15 participants) using simply their regular tooth brushing as usual | There was a considerable decrease in plaque in patients utilizing an oral irrigation device and/or an automatic toothbrush when compared to the control group, which solely used a manual toothbrush |
| 6 | Nozha Sawan <i>et al.</i> , (2022) [15] | RCT | Effectiveness of Super Floss and Water Flosser in Plaque Removal for Patients Undergoing Orthodontic Treatment: A Randomized Controlled Trial | 34 subjects | Plaque removal, using plaque index (PI) | On one side, Super-Floss® was utilized, and the Waterpik® water flosser on the other | There was no discernible difference in plaque score between the mean of a super floss and a water flosser. On the distal interproximal surface of the molar tooth, the water flosser had a bigger impact on plaque clearance than the super floss |

| Sr. No | Author, Year | Study Design | Title | Participants | Outcome Assessed | Intervention Used | Conclusion |
|--------|--|-------------------|---|------------------------------|---|---|---|
| 7 | Vera Wiesmüller <i>et al.</i> , (2023) [16] | RCT | Cleansing efficacy of an oral irrigator with microburst technology in orthodontic patients-a randomized-controlled crossover study | 17 adult individuals | Reduction in plaque levels after using an oral irrigator with microburst technology compared to dental flossing | Test group used oral irrigator and control group used dental floss | Following 28 days of oral irrigator cleaning, the RMNPI was 54.96% as opposed to 52.98% using dental floss |
| 8 | Sergio Mazzoleni <i>et al.</i> , (2019) [17] | RCT | Dental water jet efficacy in the plaque control of orthodontic patients wearing fixed appliance: A randomized controlled trial | 20 subjects | Efficacy of home oral hygiene in orthodontic patients wearing a multi-bracket fixed appliance | Each patient used dental water jet (water flosser) in addition to traditional brushing only on one side while just brushing on the control side | The trends in the plaque index (PI) and gingival index (GI) were same in the two groups |
| 9 | Paolo Caccianiga <i>et al.</i> , (2022) [18] | Comparative Study | Efficacy of Home Oral-Hygiene Protocols during Orthodontic Treatment with Multibrackets and Clear Aligners: Microbiological Analysis with Phase-Contrast Microscope | 50 patients aged 13-30 years | Impact of different oral-hygiene protocols on the oral microbiota | Patients were divided into two groups. Group A made use of one-tuft brushes, an interdental brush, and a manual orthodontic toothbrush. Group B utilized dental floss and a manual brush with gentle bristles. When harmful germs were discovered after three months, the patients were switched to using a water flosser (oral irrigator) together with a sonic toothbrush | When paired with a sonic toothbrush, the use of an oral irrigator appears to be able to improve oral hygiene in individuals who have pathogenic flora |

DISCUSSION

Among the studies included in the systematic review, one study demonstrated that there was no benefit to using water flossers for orthodontic patients. Two studies compared water flossers with other interventions and found no significant difference in the outcomes. Other studies demonstrated that there was a significant difference in the plaque index and bleeding index of the patients while using water flossers compared to the other interventions.

A study by Daniel Tyler *et al.*, involved 40 participants, of whom one withdrew from the study. According to initial statistics, the groups were around the same age, with more female patients in the control group. At baseline, there was no significant difference between the two groups in the plaque index (PI), gingival index (GI), or interdental bleeding index (IBI). The findings revealed no significant variations in PI, GI, or IBI between the control and treatment groups. The poor rate of compliance with the advised oral hygiene regimen made it inappropriate to draw any inferences from the

data. An online survey was used to gauge participant satisfaction with the oral hygiene program; however, further investigation was constrained by the survey's lack of validation. In terms of the outcomes for oral hygiene, the trial's findings generally did not indicate any appreciable differences between the groups [19].

A study performed by Nozha Sawan *et al.*, [15] in which 34 people (with an equal number of male and female subjects) were included in the research. Plaque score was the primary outcome assessed in the research, and it was discovered that following the intervention, plaque scores significantly decreased in both the super flosser and water flosser groups [15]. The mean plaque score decrease between the two groups did not significantly differ from one another. Both the super floss and water flosser groups demonstrated a substantial decrease in plaque score in canine, premolar, and molar teeth and on the mesial and distal interproximal surfaces of all teeth when comparing the efficiency of the two approaches for removing plaque from various teeth. However, the study revealed that there was no significant difference between the two groups for either super floss or water flossers, as both considerably decreased the plaque score on both the left and right sides of the mouth. Relatively similar findings were seen in another study, which was a split-mouth, single-blinded, randomized controlled trial (RCT) performed by Sergio Mazzoleni *et al.*, [17] in which a dental water jet (DWJ) was used on one side of the teeth of patients and conventional brushing on the other. The side for DWJ usage was selected at random. At the beginning and at one, three, and six months of follow-up, plaque and gingival indexes were measured. No discernible changes were seen between the two groups' trends for plaque and gingival indices, according to the findings. At the one-month examination, patients initially showed a deterioration of the indices, but at three and six months, they had recovered to baseline values. Using a dental water jet did not substantially improve the efficacy of at-home oral hygiene in orthodontic patients using a fixed device with several brackets [17].

A study by Esma Şahin *et al.*, [11] involved an oral irrigator group (OI-group) and an interdental brush group (IB-group), which were the two participant groups that were compared in this research. Over an 8-week period, the researchers assessed a number of clinical and biochemical factors associated with periodontal health clinical indicator. At the starting point, there was no difference between the groups that was statistically significant. The OI-group, in contrast to the IB-group, showed considerably lower plaque index (PI), and bleeding on probing (BOP) levels by the eighth week [11]. Similar findings were found in the research performed by J G Burch *et al.*, [14] in which the results of three different treatment plans were compared with regard to the plaque index, gingival index, pocket depth, and bleeding following probing. This study also showed that using an oral irrigation device resulted in a larger

decrease in plaque than the manual brushing control group [14].

In a randomized, one-use, single-blind, parallel clinical investigation done by C. Ram Goyal *et al.*, the effectiveness of waxed string floss and a manual toothbrush in removing plaque after a single usage was compared to that of the Water Flosser. The WF or SF group received one of the seventy adult participants. The WF group had a greater decrease in whole-mouth plaque and approximal plaque than the SF group. For both removing plaque from all surfaces and particularly near surfaces, a water flosser was found to be more successful than string floss. Additionally, the WF group outperformed the SF group in removing plaque from the marginal, lingual, and facial areas. These results implied that the Waterpik Water Flosser may be a useful instrument for enhancing dental hygiene and lowering plaque accumulation [20].

The effectiveness of three therapies for plaque removal was investigated in a study done by Naresh C Sharma *et al.*, a manual toothbrush alone (MT group), a manual toothbrush plus a water flosser (DWJ group), and conventional floss alone (FL group). There were statistically significant decreases in whole-mouth plaque, interproximal area plaque, bleeding index (BI), and interproximal area bleeding in all the three therapy groups. At both the 2-week and 4-week visits, the DWJ group consistently outperformed the other groups, with the FL group performing about as effectively as the MT group and the MT group performing about as poorly. The study proved that the water flosser in conjunction with a manual toothbrush (DWJ) was the most successful method for reducing plaque, followed by conventional floss in conjunction with a manual toothbrush (FL) (13).

Vera Wiesmüller *et al.*, performed a study in which the efficacy of conventional dental flossing and interdental cleaning using an oral irrigator employing microburst technology was compared. Although both approaches improved over baseline, the findings indicated that the oral irrigator was more efficient in lowering plaque levels than dental flossing. The oral irrigator, however, was linked to more gingival bleeding than dental flossing, especially in the marginal and approximal regions and in front teeth [16].

Paolo Caccianiga *et al.*, performed a study in which 50 patients were assessed for their periodontal condition before treatment. Patients were divided into two groups. Group A made use of one-tuft brushes, an interdental brush, and a manual orthodontic toothbrush. Group B utilized dental floss and a manual brush with gentle bristles. All patients demonstrated non-pathogenic bacterial flora, indicating a good periodontal status. After three months of orthodontic treatment, 10 out of 25 patients in the multibracket group (group A) and 3 out of 25 patients in the aligners group (group B) exhibited a transition to pathogenic bacterial flora (T1), and those

patients were switched to using a water flosser (oral irrigator) together with a sonic toothbrush. After an additional three months of treatment (T2), all 50 patients achieved a microbiological outcome of non-pathogenic bacterial flora. It showed that the use of an oral irrigator appears to be able to improve oral hygiene in individuals who have pathogenic flora [18].

CONCLUSION

Maintaining good oral hygiene is challenging for individuals with fixed orthodontic appliances. Traditional tools may not effectively clean hard-to-reach areas, leading to complications. Water flossers, with their pulsating water jets, can effectively remove plaque and debris from interdental spaces and reduce the plaque index and bleeding index. They offer an easy and convenient solution for improving oral hygiene during orthodontic treatment.

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