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COMPARATIVE EFFICACY OF WATER FLOSSERS AND TRADITIONAL DENTAL FLOSS IN THE CONTROL OF DENTAL PLAQUE: A SYSTEMATIC REVIEW OF CLINICAL EVIDENCE

EFICÁCIA COMPARATIVA DE IRRIGADORES ORAIS E FIO DENTAL TRADICIONAL NO CONTROLE DA PLACA BACTERIANA: UMA REVISÃO SISTEMÁTICA DE EVIDÊNCIAS CLÍNICAS

EFICACIA COMPARATIVA DE LOS IRRIGADORES BUCALES Y EL HILO DENTAL TRADICIONAL EN EL CONTROL DE LA PLACA DENTAL: UNA REVISIÓN SISTEMÁTICA DE LA EVIDENCIA CLÍNICA

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ABSTRACT

Objective : This systematic review aims to evaluate and compare the efficacy of water flossers and traditional dental floss in the removal of dental plaque and food debris, considering their applicability across different patient populations.

Methods: A systematic literature search was performed in PubMed, EMBASE, and Cochrane Library up to August 2025. The search strategy combined MeSH and free-text terms: (periodontitis OR periodontal OR periodont* OR “gum disease” OR “periodontal infection” OR “periodontal inflammation” OR “chronic periodontitis”) AND (water flosser OR oral irrigator OR “water jet” OR “oral irrigation”) AND (dental floss OR interdental cleaning). Randomized

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controlled trials (RCTs), clinical trials, and systematic reviews published in English, Portuguese, or Spanish were included. Studies were managed in Zotero for duplicate removal. Titles and abstracts were screened independently by two reviewers. Full texts were assessed according to predefined eligibility criteria.

Results: Twenty-five studies met inclusion criteria, comprising RCTs, integrative reviews, and systematic reviews. Both water flossers and dental floss significantly reduced plaque accumulation. Water flossers demonstrated superior efficacy in patients with orthodontic appliances, dental implants, prostheses, or motor limitations. Some trials showed marginal superiority of water flossers in plaque reduction (20–30% greater than dental floss), while others found no significant difference. Evidence suggests that water flossers enhance patient adherence and comfort, though concerns remain about microbial colonization of device tips and potential marginal microleakage in crowns.

Conclusion: Both water flossers and traditional dental floss are effective in plaque and debris removal. Water flossers appear slightly superior in special populations and in accessing difficult interproximal regions. Individualized recommendations should be made based on patients' clinical conditions, manual dexterity, and prosthetic or orthodontic status. Further high-quality, long-term RCTs are required to confirm the superiority of water flossers in different clinical contexts.

Keywords: Water Flosser. Dental Floss. Interdental Cleaning. Oral Irrigator. Biofilm Control. Periodontal Health.

RESUMO

Objetivo: Esta revisão sistemática tem como objetivo avaliar e comparar a eficácia do irrigador oral e do fio dental tradicional na remoção de placa bacteriana e restos alimentares, considerando sua aplicabilidade em diferentes populações de pacientes.

Métodos: Uma busca sistemática da literatura foi realizada no PubMed, EMBASE e Biblioteca Cochrane até agosto de 2025. A estratégia de busca combinou MeSH e termos em texto livre: (periodontitis OR periodontal OR periodontal* OR "gum disease" OR "periodontal infection" OR "periodontal inflammation" OR "chronic periodontitis") AND (water flosser OR oral irrigator OR "water jet" OR "oral irrigation") AND (dental floss OR interdental cleaning). Foram incluídos ensaios clínicos randomizados (ECRs), ensaios clínicos e revisões sistemáticas publicados em inglês, português ou espanhol. Os estudos foram gerenciados no Zotero para remoção de duplicatas. Títulos e resumos foram avaliados independentemente por dois revisores. Os textos completos foram avaliados de acordo com os critérios de elegibilidade predefinidos.

Resultados: Vinte e cinco estudos preencheram os critérios de inclusão, incluindo ECRs, revisões integrativas e revisões sistemáticas. Tanto o irrigador oral quanto o fio dental reduziram significativamente o acúmulo de placa bacteriana. O irrigador oral demonstrou eficácia superior em pacientes com aparelhos ortodônticos, implantes dentários, próteses ou limitações motoras. Alguns estudos demonstraram superioridade marginal do irrigador oral na redução de placa bacteriana (20 a 30% maior que o fio dental), enquanto outros não encontraram diferença significativa. As evidências sugerem que o irrigador oral aumenta a adesão e o conforto do paciente, embora ainda existam preocupações quanto à colonização microbiana das pontas dos dispositivos e à potencial microinfiltração marginal nas coroas.

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Conclusão: Tanto o irrigador oral quanto o fio dental tradicional são eficazes na remoção de placa bacteriana e detritos. O irrigador oral parece ser ligeiramente superior em populações especiais e no acesso a regiões interproximais difíceis. Recomendações individualizadas devem ser feitas com base nas condições clínicas do paciente, na destreza manual e no estado protético ou ortodôntico. Mais ECRs de alta qualidade e longo prazo são necessários para confirmar a superioridade dos irrigadores orais em diferentes contextos clínicos.

Palavras-chave: Irrigador Bucal. Fio Dental. Limpeza Interdental. Irrigador Oral. Controle de Biofilme. Saúde Periodontal.

RESUMEN

Objetivo: Esta revisión sistemática busca evaluar y comparar la eficacia de los irrigadores bucales y el hilo dental tradicional para eliminar la placa y los restos de alimentos, considerando su aplicabilidad en diferentes poblaciones de pacientes.

Métodos: Se realizó una búsqueda sistemática de la literatura en PubMed, EMBASE y la Biblioteca Cochrane hasta agosto de 2025. La estrategia de búsqueda combinó términos MeSH y de texto libre: (periodontitis OR periodontal OR periodontal* OR “enfermedad de las encías” OR “infección periodontal” OR “inflamación periodontal” OR “periodontitis crónica”) AND (flosser de agua OR irrigador bucal OR “chorro de agua” OR “irrigación bucal”) AND (hilo dental OR limpieza interdental). Se incluyeron ensayos controlados aleatorizados (ECA), ensayos clínicos y revisiones sistemáticas publicadas en inglés, portugués o español. Los estudios se gestionaron en Zotero para eliminar duplicados. Los títulos y resúmenes fueron evaluados de forma independiente por dos revisores. Los textos completos se evaluaron según criterios de elegibilidad predefinidos.

Resultados: Veinticinco estudios cumplieron los criterios de inclusión, incluyendo ECA, revisiones integrativas y revisiones sistemáticas. Tanto los irrigadores bucales como el hilo dental redujeron significativamente la acumulación de placa. Los irrigadores bucales demostraron una eficacia superior en pacientes con aparatos de ortodoncia, implantes dentales, prótesis dentales o limitaciones motoras. Algunos estudios demostraron una superioridad marginal de los irrigadores bucales en la reducción de placa (entre un 20 % y un 30 % mayor que el hilo dental), mientras que otros no encontraron diferencias significativas. La evidencia sugiere que los irrigadores bucales aumentan la adherencia y la comodidad del paciente, aunque persiste la preocupación por la colonización microbiana de las puntas de los dispositivos y la posible microfiltración marginal en las coronas.

Conclusión: Tanto los irrigadores bucales como el hilo dental tradicional son eficaces para eliminar la placa y los residuos. Los irrigadores bucales parecen ser ligeramente superiores en poblaciones especiales y para acceder a zonas interproximales difíciles. Se deben realizar recomendaciones individualizadas según el estado clínico del paciente, la destreza manual y el estado protésico u ortodóncico. Se necesitan más ECA de alta calidad a largo plazo para confirmar la superioridad de los irrigadores bucales en diferentes entornos clínicos.

Palabras clave: Irrigador Bucal. Hilo Dental. Limpieza Interdental. Irrigador Bucal. Control de Biopelícula. Salud Periodontal.

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1 INTRODUCTION

Dental plaque is a highly organized biofilm composed of a complex microbial community that adheres firmly to tooth surfaces. It develops when pioneer colonizers, such as Streptococcus species, attach to the acquired pellicle, followed by secondary colonizers that contribute to the maturation of the biofilm (Marsh, 2005). This oral biofilm plays a central role in the pathogenesis of dental caries, gingivitis, and periodontal diseases, particularly when mechanical oral hygiene is inadequate (Löe, Theilade, & Jensen, 1965).

The daily mechanical removal of plaque is essential for maintaining periodontal health. Correct brushing with fluoride toothpaste effectively reduces supragingival biofilm (Haffajee, Socransky, & Patel, 2005; Moeintaghavi et al., 2017). However, toothbrushing alone removes only about 60% of the plaque adhered to tooth surfaces, leaving interdental and subgingival areas largely unaffected (Lamont & Jenkinson, 2010). These areas, inaccessible to toothbrush bristles, are critical initiation sites for periodontal problems (Van der Weijden & Slot, 2011). Therefore, the use of complementary mechanical methods is indispensable. Dental floss remains the most traditional and widely recommended adjunctive tool for interdental cleaning, performed by gentle sliding movements between teeth to mechanically disrupt the biofilm (Chapple & Van der Weijden, 2019). When used correctly, floss can remove plaque effectively from interdental spaces. However, its efficacy is highly dependent on patient compliance and manual dexterity, which presents limitations for children, elderly individuals, and patients with orthodontic appliances, implants, or motor disabilities (Imai et al., 2021).

The water flosser (oral irrigator) represents a more recent adjunctive option. It is a device that delivers a pulsating jet of pressurized water through a reservoir-controlled nozzle, directed at the gingival margin and interdental areas (Goyal et al., 2012). Evidence suggests that water flossers are at least as effective as dental floss in removing plaque, and in certain contexts, may even surpass flossing by improving gingival health and reducing bleeding on probing (Rosema et al., 2011; Goyal et al., 2013; Worthington et al., 2019). A systematic review by Al-Mubarak et al. (2020) concluded that water flossers significantly improved gingival inflammation compared with string floss, especially in patients with orthodontic appliances and implants.

More recently, a systematic review and meta-analysis by Serrano et al. (2020) reported that while both floss and water flossers reduce plaque levels, irrigators demonstrated superior performance in reducing gingival bleeding and inflammation. Another meta-analysis (Sharma

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et al., 2021) reinforced that oral irrigators can be more effective in sites where conventional floss is challenging to use, thus improving patient adherence to interdental cleaning regimens.

Given these findings, there is a growing interest in determining whether water flossers should be recommended as a standard adjunct to toothbrushing, especially for populations with special clinical needs. Therefore, this review aims to synthesize and critically evaluate the comparative efficacy of dental floss and water flossers in removing plaque

2 METHODOLOGY

2.1 PROTOCOL AND REGISTRATION

This review followed PRISMA 2020 guidelines. The protocol was prospectively developed but not registered in PROSPERO due to narrative elements included.

2.2 DATABASES AND SEARCH STRATEGY

A comprehensive search was conducted in PubMed, EMBASE, and Cochrane Library (from inception to August 2025). The search terms included: (periodontitis OR periodontal OR periodont* OR "gum disease" OR "periodontal infection" OR "periodontal inflammation" OR "chronic periodontitis") AND ("water flosser" OR "oral irrigator" OR "oral irrigation" OR "water jet") AND ("dental floss" OR "interdental cleaning").

2.3 INCLUSION CRITERIA

1. Randomized controlled trials, controlled clinical trials, systematic reviews, and meta-analyses.
2. Studies evaluating the effect of water flossers versus dental floss on plaque index, bleeding on probing, gingival index, food debris removal, or periodontal outcomes.
3. Participants: healthy individuals or patients with periodontal disease, orthodontic appliances, implants, or prostheses.
4. Adults and adolescents (≥12 years).

2.4 EXCLUSION CRITERIA

1. Case reports, letters, and expert opinions.
2. In vitro or animal studies.
3. Studies without direct comparison between water flossers and dental floss.

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2.5 STUDY SELECTION AND DATA EXTRACTION

All retrieved citations were exported to Zotero. Duplicates were removed. Two independent reviewers screened titles and abstracts, followed by full-text assessment. Disagreements were resolved by consensus. Data extracted included study design, sample size, participant characteristics, intervention details, outcomes, and conclusions.

3 RESULTS

The review of available literature reveals that both dental floss and water flossers effectively remove dental plaque and debris, but their comparative performance and clinical relevance vary depending on the population and methodology of the study.

3.1 SINGLE-USE RANDOMIZED CLINICAL TRIALS (RCTS)

1. Abdellatif et al. (2021) conducted an RCT comparing one-time use of dental floss versus a water flosser. Both devices demonstrated significant plaque reduction of 89.09% for dental floss and 87.23% for the water flosser. Although these results indicate both are highly effective, the water flosser was highlighted as particularly advantageous for patients with fixed prostheses, orthodontic appliances, or impaired motor skills due to easier handling (Abdellatif et al., 2021).
2. Goyal et al. (2013) compared manual brushing plus water flosser against brushing plus floss. The water flosser group showed significantly greater plaque removal, especially in interdental regions difficult to access with traditional floss (Goyal et al., 2013).

3.2 SHORT-TERM MULTI-WEEK TRIALS

1. Goyal et al. (2018) evaluated gingival inflammation: participants brushing twice a day plus using a water flosser once daily exhibited greater reductions in bacterial plaque and bleeding on probing than those relying solely on manual brushing (Goyal et al., 2018).
2. Sawan et al. (2022) focused on orthodontic patients and compared water flossers with super floss. Both were effective in plaque removal, but the water flosser performed slightly better on distal molar surfaces (Sawan et al., 2022).

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3.3 FOUR-WEEK CONTROLLED TRIALS

1. A robust RCT with 105 participants randomized to flossing, water flosser, or water flosser with microbubbles found that water flossers significantly outperformed dental floss in reducing plaque, gingival bleeding, and inflammation up to twice as effective overall, and up to seven times more effective in proximal areas (Lyle et al., 2023).

3.4 ORTHODONTIC PATIENTS

1. A 14-day trial among orthodontic patients showed both water flosser and interdental flossing significantly reduced plaque and gingival bleeding. Although the water flosser showed slightly better improvements, the differences were not statistically significant (Ganzer et al., 2024).

3.5 LONG-TERM AND MICROBIOLOGICAL OUTCOMES

1. A 12-week RCT combining toothbrushing with water flossing demonstrated significant reductions in gingival inflammation and halitosis, along with a shift in supragingival microbiota depleting Prevotella species and promoting a more aerobic biofilm composition (Shen et al., 2023).

3.6 SYSTEMATIC REVIEWS AND META-ANALYSES

1. A systematic review of RCTs concluded that most studies favor water flossers over dental floss in plaque reduction, particularly for patients with manual dexterity issues, orthodontic appliances, or dental prostheses (Al-Mubarak et al., 2020).
2. A broader meta-analysis found that adding water irrigation to a toothbrush enhances clinical parameters: plaque, bleeding, and gingival indices more effectively than flossing, especially in short-term studies (Serrano et al., 2020).

3.7 ADDITIONAL OBSERVATIONS

1. Bertl et al. (2021) warned of bacterial colonization on water flosser tips after three weeks of use, highlighting the need for adequate cleaning.
2. Al-Sughaier et al. (2023) reported marginal microleakage around crowns cemented with certain materials when using water flossers, suggesting cautious application in prosthetic cases.

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3. Campos et al. (2024) and Ferraz & Carvalho (2022) concluded that both methods are effective, but water flossers offer distinctive advantages for children, individuals with motor limitations, or patients with prosthetic and orthodontic needs. However, they stressed the importance of further RCTs to confirm superiority.

Table 1

Summary Table of Selected Studies

Study & Year	**Population / Context**	**Findings Summary**
Abdellatif et al., 2021	Single-use, general population	Comparable plaque reduction; floss slightly higher, but flosser easier use
Goyal et al., 2013	Supragingival plaque removal	Brush + flosser > Brush + floss in hard-to-access areas
Goyal et al., 2018	Gingival inflammation	Flosser adjunct reduced plaque and bleeding more than brushing alone
Sawan et al., 2022	Orthodontic patients	Both effective; flosser better on molars
Lyle et al., 2023	4-week RCT, general population	Flosser substantially better than floss across all measures
Ganzer et al., 2024	Orthodontic patients	Similar benefits; flosser slight edge (not significant)
Shen et al., 2023	Gingivitis & microbiota change	Flosser + brushing reduced inflammation, altered microbiota
Al-Mubarak et al., 2020	Adults and multiple RCTs	Most RCTs favor flosser; better for certain patient groups
Serrano et al., 2020	Short-term outcomes vs flossing	Flosser + brush improved outcomes more than floss + brush

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4 DISCUSSION

The findings of this review confirm that both dental floss and water flossers are effective in reducing plaque accumulation and food debris. However, their relative efficacy and clinical applicability vary depending on patient characteristics and specific oral health conditions.

Several randomized controlled trials demonstrated that water flossers can achieve comparable or superior plaque reduction compared to dental floss. Goyal et al. (2013) reported significantly greater plaque removal when water flossers were used in conjunction with toothbrushing, particularly in interproximal areas that are difficult to access with traditional floss. Similarly, Batool et al. (2021) and Behera et al. (2023) found that plaque reduction was 20–30% greater in water flosser groups compared to floss, highlighting their potential to improve interdental cleaning efficacy. On the other hand, studies such as Gänzer et al. (2024) found no statistically significant difference between the two methods, suggesting that patient compliance and proper technique may be as important as the device itself.

Special populations represent an important consideration in the choice of interdental cleaning aids. In orthodontic patients, who face challenges in cleaning around brackets and wires, water flossers demonstrated superior outcomes in plaque reduction and gingival health compared to floss or super floss (Sawan et al., 2022). Similarly, in individuals with implants or prostheses, water flossers were more effective in maintaining peri-implant tissue health (Kuru et al., 2018). Patients with limited manual dexterity, such as children or individuals with neuromotor disabilities, also benefited from the ease of use of water flossers (Nasiloski et al., 2015). These findings support the integration of water flossers as a practical solution in populations for whom dental floss is difficult to manipulate effectively.

Beyond plaque reduction, improvements in gingival health indicators, including reductions in bleeding on probing and gingival inflammation, were consistently reported in studies favoring water flossers (Goyal et al., 2018; Altalhi et al., 2023). This suggests that the benefits of water flossing may extend beyond mechanical plaque disruption, possibly due to the additional flushing of debris and subgingival biofilm.

Nevertheless, some limitations of water flossers must be acknowledged. Bertl et al. (2021) identified bacterial colonization of device tips after repeated use, which underscores the need for adequate cleaning and maintenance of the device. Furthermore, Al-Sughaier et al. (2023) cautioned against their use in certain prosthetic situations, as irrigation may lead to marginal microleakage in crowns cemented with specific materials. Additionally, cost and

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accessibility may limit the widespread adoption of water flossers in lower-income populations, despite their demonstrated clinical efficacy.

Taken together, the current body of evidence suggests that water flossers represent a valuable adjunct to toothbrushing, with potential superiority over dental floss in terms of patient compliance, ease of use, and clinical outcomes in specific contexts. However, the heterogeneity of study designs, sample sizes, and outcome measures complicates direct comparisons and limits the strength of definitive recommendations. Future research directions should include large-scale, long-term randomized controlled trials with standardized protocols and outcome measures to establish stronger evidence for clinical guidelines. Comparative studies on cost-effectiveness and patient-centered outcomes, such as adherence and satisfaction, would also be valuable to inform real-world applicability.

In conclusion, while both devices remain effective, water flossers may provide an incremental benefit in plaque control and gingival health, particularly in populations with special needs. Personalized recommendations by dental professionals remain essential, with the choice of interdental cleaning device tailored to each patient's clinical condition, dexterity, and lifestyle.

5 CONCLUSION

Over the years, dentistry has undergone continuous advancements, with the development of new technologies, innovative procedures, and improved preventive strategies aimed at enhancing patient outcomes. Among these innovations, the water flosser has emerged as a promising adjunctive tool for interdental cleaning, offering an alternative to traditional dental floss, which has long been considered the standard of care. The evidence synthesized in this review indicates that both dental floss and water flossers are effective in reducing dental plaque and food debris. However, water flossers appear to provide additional benefits in specific populations, particularly in individuals with orthodontic appliances, fixed prostheses, dental implants, limited manual dexterity, or in pediatric patients. Several randomized controlled trials and systematic reviews support the slightly superior performance of water flossers in reducing plaque and gingival inflammation, particularly in hard-to-reach interproximal and subgingival areas.

Despite these advantages, the choice of interdental cleaning device should remain individualized, taking into account the patient's oral health status, manual skills, compliance, and personal preferences. Dentists play a key role in tailoring recommendations to ensure

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optimal adherence and long-term periodontal stability. At the same time, important limitations must be acknowledged. Water flossers may pose risks such as bacterial colonization of device tips or, in specific prosthetic situations, marginal microleakage. Furthermore, their higher cost and lower accessibility may hinder widespread adoption in some populations.

Therefore, while water flossers represent a valuable adjunct to daily oral hygiene and may offer advantages over traditional floss in certain clinical contexts, further well-designed, long-term randomized clinical trials are essential to confirm their superiority, establish standardized protocols, and strengthen clinical guidelines. Ultimately, the integration of water flossers into individualized oral hygiene regimens has the potential to significantly improve periodontal health and quality of life across diverse patient groups.

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