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A SYSTEMATIC REVIEW ON THE IMPACT OF FULL-MOUTH DISINFECTION VERSUS CONVENTIONAL STAGED SCALING AND ROOT PLANING ON CLINICAL PARAMETERS AND PATIENT-REPORTED OUTCOMES

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Abstract

Background: Periodontitis is a chronic inflammatory disease with a high global prevalence, affecting over a billion individuals worldwide. Conventional staged scaling and root planing (SRP), the established standard of care, involves treating the mouth in quadrants over multiple appointments. This protracted schedule can present a substantial barrier to treatment completion, particularly in contexts with limited healthcare access and for patients facing logistical or financial challenges. Full-Mouth Disinfection (FMD), an alternative protocol that completes the entire non-surgical therapy within 24 hours, has been proposed as a promising alternative to overcome these limitations.

Objective: The primary aim of this systematic review is to compare the effectiveness of Full-Mouth Disinfection versus conventional staged scaling and root planing on primary clinical outcomes (Probing Depth reduction, Bleeding on Probing) and key secondary patient-reported outcomes (patient comfort, treatment time) for adult patients with periodontitis.

Methods: This systematic review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines. A comprehensive search of electronic databases, including Medline, Embase, and the Cochrane Central Register of Controlled Trials (CENTRAL), was performed to identify relevant randomized controlled trials (RCTs). Studies were selected based on a predefined PICO framework. The primary outcomes were Probing Depth (PD) reduction and change in Bleeding on Probing (BOP). Secondary outcomes included patient comfort, assessed via a Visual Analogue Scale (VAS), and total active treatment time.

Results: A total of 15 RCTs involving 850 participants were included in the final synthesis. The analysis revealed no statistically significant or clinically meaningful differences between FMD and staged SRP for the primary clinical outcomes of PD reduction and BOP improvement. This finding aligns with conclusions from major systematic reviews, which report that any observed differences are modest and of low clinical relevance. However, a significant and consistent difference was found for secondary outcomes. FMD protocols were substantially more time-efficient, reducing the total active treatment time and number of patient visits. This efficiency may be counterbalanced by reports of higher initial post-operative discomfort and a greater incidence of minor side effects, such as transient fever, in the FMD group.

Conclusion: While Full-Mouth Disinfection offers no clear clinical superiority over conventional staged SRP in terms of periodontal parameter improvement, its condensed treatment schedule presents a significant logistical advantage. In healthcare settings where patient adherence to multi-visit protocols is a concern, FMD could be a valuable public health strategy to improve treatment completion rates and overall clinic efficiency. Future research is recommended to evaluate the cost-effectiveness, patient acceptance, and long-term outcomes of this consolidated treatment approach in various clinical and demographic settings.

Keywords: Full-Mouth Disinfection, Staged Scaling and Root Planing, Periodontitis, Probing

Depth, Patient-Reported Outcomes, Treatment Time, Clinical Outcomes.

INTRODUCTION

The Global Burden and Pathophysiology of Periodontitis

Periodontitis is a chronic, multifactorial inflammatory disease initiated by a dysbiotic microbial biofilm that leads to the progressive destruction of the tooth-supporting apparatus, including the periodontal ligament and alveolar bone **[1]**. The disease process typically begins as reversible gingivitis, but in susceptible individuals, it advances as the subgingival environment shifts to favor anaerobic, gram-negative pathogens such as Porphyromonas gingivalis, Tannerella forsythia, and Treponema denticola **[2]**. These organisms trigger a persistent and destructive host immune-inflammatory response, characterized by the release of cytokines, prostaglandins, and enzymes that mediate tissue breakdown, leading to periodontal pocket formation, attachment loss, and eventual tooth loss if left untreated **[3]**.

Globally, periodontitis constitutes a major public health challenge. According to the Global Burden of Disease 2021 study, severe periodontitis affects over one billion people, with a global age-standardized prevalence of 12.5% **[4]**. The World Health Organization (WHO) recognizes severe periodontal disease as one of the most common oral health conditions, with projections indicating a substantial increase in the number of affected individuals, a 44% rise in cases is anticipated by 2050, driven by population growth and aging **[5]**. This high prevalence translates into significant impacts on quality of life, including impaired mastication and aesthetics, and is increasingly linked to systemic conditions such as cardiovascular disease and diabetes **[1]**.

Periodontitis as a Public Health Challenge

The burden of periodontitis is exacerbated by a confluence of risk factors that are highly prevalent in many populations. Studies have established strong correlations between the presence of periodontitis and factors such as lower socioeconomic status, smoking, and diabetes **[6]**. These determinants are often compounded by systemic challenges within healthcare frameworks. Data from the WHO highlights a critical lack of engagement with dental services in many regions; a significant proportion of individuals with active dental problems do not seek professional care, driven by factors including high out-of-pocket expenditures for health and the absence of robust national policies focused on oral health prevention and management.

Conventional Staged SRP: The Established Standard of Care and Its Practical Limitations

The cornerstone and "gold standard" for non-surgical management of periodontitis is scaling and root planing (SRP) **[7]**. This meticulous procedure involves the mechanical removal of bacterial plaque and calculus from tooth surfaces, both above and below the gumline, to disrupt the pathogenic biofilm and create a root surface that is biologically compatible with periodontal health **[8]**. The conventional approach to this therapy is staged, typically dividing the mouth into four quadrants, with each quadrant being treated in a separate appointment scheduled one to two weeks apart **[9]**. This methodology is predicated on providing manageable treatment sessions for both the clinician and the patient, allowing for adequate healing time between appointments and facilitating reinforcement of oral hygiene practices **[10]**.

Despite its established efficacy, the staged protocol has theoretical and practical limitations. A key theoretical concern is the potential for microbial translocation, whereby pathogenic bacteria from untreated quadrants can recolonize the freshly debrided sites, potentially compromising the treatment outcome **[11]**. However, a more pressing challenge is logistical. The requirement for multiple appointments creates a significant barrier to care for a large segment of the population. Patients often face substantial hurdles, including the direct cost of each visit, indirect costs associated with travel and lost wages, and the difficulty of scheduling multiple appointments. These cumulative barriers contribute to a high rate of treatment non-completion, leaving the disease process unresolved and underscoring a critical "adherence gap" in periodontal care delivery.

The Full-Mouth Disinfection Protocol: Rationale for a Consolidated Approach

To address the shortcomings of the conventional staged approach, the Full-Mouth Disinfection (FMD) protocol was introduced in the 1990s **[12]**. FMD is an intensive treatment modality designed to complete the entire course of non-surgical therapy within a 24-hour period, typically over two long appointments on consecutive days **[11]**. The original protocol, as described by Quirynen et al., consists of two core components: comprehensive full-mouth scaling and root planing, and the adjunctive use of a broad-spectrum antiseptic, most commonly chlorhexidine (CHX), applied to all potential oral reservoirs of periodontopathogens **[12]**. This includes subgingival irrigation of all periodontal pockets, tongue brushing with CHX gel, and mouth rinsing to decontaminate the oral mucosa and tonsillar areas **[11]**.

The primary rationale for FMD is microbiological. By drastically and simultaneously reducing the total bacterial load throughout the oral cavity, the protocol aims to prevent the reinfection of treated pockets from untreated niches, thereby creating a more favorable environment for periodontal healing and potentially leading to superior clinical outcomes **[10]**. This consolidated approach also offers a compelling practical advantage by minimizing the number of patient visits required to complete therapy.

Rationale, Research Question, and Hypotheses

While numerous international systematic reviews have compared the clinical efficacy of FMD and staged SRP, the evidence remains equivocal. Some meta-analyses suggest modest clinical benefits for FMD, while the most recent

and comprehensive Cochrane review finds no clear evidence of superiority for either approach **[9]**. This systematic review is therefore necessary to synthesize the existing evidence on both clinical and patient-centered outcomes to determine if the logistical benefits of FMD, namely the reduction in patient visits, justify its broader adoption in healthcare systems where treatment completion is a primary concern.

The central research question for this review is: In adult patients with periodontitis, how does Full-Mouth Disinfection compare to conventional staged scaling and root planing in terms of clinical efficacy (Probing Depth reduction, Bleeding on Probing) and patient-reported outcomes (comfort, treatment time)?

Based on the existing body of evidence, the following hypotheses were formulated:

- **Primary Hypothesis:** FMD and staged SRP will demonstrate comparable improvements in the clinical parameters of Probing Depth reduction and reduction in Bleeding on Probing.
- **Secondary Hypothesis:** FMD will be significantly more time-efficient in terms of total active treatment duration and number of visits but will be associated with greater short-term post-operative discomfort compared to staged SRP.

LITERATURE REVIEW

Mechanisms of Non-Surgical Periodontal Therapy

The fundamental objective of non-surgical periodontal therapy is to halt the progression of periodontitis by addressing its etiological cause: the pathogenic subgingival biofilm **[13]**. The mechanical debridement performed during scaling and root planing aims to achieve several key goals: the disruption and removal of the microbial biofilm, the elimination of plaque-retentive factors such as calculus, and the detoxification of the root surface to render it biologically compatible with the healing of adjacent periodontal tissues **[7]**. Successful therapy results in a reduction of the inflammatory load, leading to a decrease in probing depths, resolution of bleeding on probing, and a gain in clinical attachment, thereby creating a stable and maintainable periodontal environment **[14]**.

The conventional staged SRP approach achieves this goal incrementally. By treating one quadrant at a time over several weeks, the overall bacterial load is gradually reduced. This method is often favored for its manageable session lengths, which can enhance operator ergonomics and patient comfort, and provides multiple opportunities to reinforce oral hygiene instructions between visits **[5]**. In contrast, the FMD protocol is based on a different therapeutic philosophy. Its mechanism is rooted in the hypothesis that a rapid and comprehensive eradication of periodontal pathogens from all oral reservoirs, including periodontal pockets, the dorsum of the tongue, saliva, and tonsillar crypts, is necessary to prevent the immediate recolonization of treated sites **[8]**. This simultaneous, full-mouth approach is theorized to create a more profound shift in the oral microbiome and may elicit a more robust systemic host response, potentially leading to more predictable and superior healing outcomes compared to the gradual debridement of staged therapy **[14]**.

Global Evidence Synthesis: A Critical Look at Previous Reviews and Meta-Analyses

The comparative efficacy of FMD and staged SRP has been a subject of extensive research and debate for over two decades, leading to a large body of evidence synthesized in numerous systematic reviews and meta-analyses. Early reviews and several subsequent meta-analyses reported that FMD may offer modest, yet statistically significant, additional clinical benefits over staged SRP. For instance, a 2015 meta-analysis found that FMD resulted in a greater mean probing pocket depth (PPD) reduction of 0.25 mm and a greater clinical attachment level (CAL) gain of 0.33 mm in moderate pockets when compared to quadrant-wise SRP **[10]**. These findings lent support to the theoretical advantages of the FMD protocol.

However, this perspective must be critically contrasted with the findings of the most recent and methodologically rigorous Cochrane systematic review, last updated in 2022. After analyzing an expanded set of randomized controlled trials, the Cochrane review concluded that there is **no clear evidence** that FMD or its variant, Full-Mouth Scaling (FMS, performed without adjunctive antiseptics), provides additional clinical benefit compared to conventional staged SRP. The review found no significant differences between the treatment modalities for the primary outcomes of PPD reduction, CAL gain, or reduction in bleeding on probing (BOP) **[9]**. The authors of the Cochrane review noted that the certainty of the evidence was generally low to very low, and any observed treatment effects were modest at best.

The discrepancy between these reviews highlights a central issue in the interpretation of the available evidence: the distinction between statistical significance and clinical relevance. The small mean differences reported in some meta-analyses (e.g., 0.25 mm) are unlikely to be clinically meaningful, as such a small change does not typically alter a clinician's treatment plan or affect the long-term prognosis of a tooth. This value is smaller than the diameter of a standard periodontal probe tip and falls within the range of measurement error. Therefore, the debate over these marginal statistical differences may obscure the more practical and impactful distinctions between the two protocols, such as the total treatment time and the number of patient visits. For the purposes of clinical decision-making, the weight of the current evidence suggests that the two approaches should be considered clinically equivalent in their therapeutic efficacy.

Implementing Advanced Periodontal Therapies: Barriers and Opportunities

The translation of global evidence on periodontal therapies into clinical practice requires careful consideration of local barriers and opportunities. The primary barriers to implementing any form of comprehensive periodontal care are

often socioeconomic and infrastructural. The high cost of dental treatment, coupled with limited insurance coverage and high out-of-pocket expenditures in many healthcare systems, places a significant financial burden on patients **[15]**. This economic pressure often leads to patients forgoing or delaying necessary care. Furthermore, a lack of national clinical practice guidelines and organized public health programs for the prevention and management of periodontitis in many countries contributes to low public awareness and inconsistent standards of care.

Despite these challenges, the unique characteristics of the FMD protocol present distinct opportunities. The most significant of these is its efficiency. By consolidating treatment into a single 24-hour period, FMD drastically reduces the number of required patient visits **[16]**. This is a powerful advantage in many settings. For patients in rural or remote areas, minimizing travel to dental centers can significantly reduce the indirect costs and logistical complexity of receiving care **[6]**. For both public and private clinics facing high patient volumes, FMD can improve operational efficiency and patient throughput, allowing a greater number of individuals to receive complete non-surgical therapy in the same amount of total clinical time **[10]**. This efficiency aligns well with the need to address the high prevalence of disease within resource-constrained systems.

Restating the Knowledge Gap

The existing international literature, while extensive, is ultimately equivocal on the question of clinical superiority between FMD and staged SRP. The most robust evidence suggests clinical equivalence. Therefore, the critical unanswered question is not which treatment produces marginally better pocket reduction, but which delivery model has a greater real-world impact on treatment completion, cost-effectiveness, and patient acceptance. The current body of evidence lacks studies that specifically address these pragmatic outcomes across diverse healthcare settings, including low- or middle-income countries. This systematic review aims to fill this gap by synthesizing the available clinical and patient-reported data to provide an evidence-based foundation for evaluating the role of FMD, shifting the focus from a debate on marginal efficacy to a discussion on practical feasibility and public health impact.

METHODS

Study Design

This systematic review was designed, conducted, and reported in strict accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 statement. A protocol for this review was established prior to the commencement of the literature search to ensure methodological rigor and transparency.

PICO Framework

The research question was structured using the PICO framework to guide the study selection process:

- **P (Population):** Systemically healthy adult patients (aged 18 years or older) with a clinical diagnosis of chronic or aggressive periodontitis, irrespective of severity.
- **I (Intervention):** Full-Mouth Disinfection (FMD), defined as non-surgical scaling and root planing of all quadrants of the mouth completed within a 24-hour period. This included protocols performed with or without the adjunctive use of a chemical antiseptic agent (e.g., chlorhexidine).
- **C (Comparison):** Conventional Staged Scaling and Root Planing (SRP), defined as non-surgical scaling and root planing delivered on a quadrant-by-quadrant or sextant-by-sextant basis over multiple appointments, with a minimum interval of one week between treatment sessions.
- **O (Outcomes):**
  - **Primary Outcomes:**
    1. Change in mean Probing Depth (PD), measured in millimeters (mm) from baseline to the final follow-up point.
    2. Change in Bleeding on Probing (BOP), expressed as a percentage of sites.
  - **Secondary Outcomes:**
    1. Total active treatment time, measured in minutes.
    2. Patient-reported post-operative pain or discomfort measured using a Visual Analogue Scale (VAS) or a similar validated pain scale.

Eligibility Criteria

Studies were included in this review if they met the following criteria:

- **Inclusion Criteria:**
  - Study Design: Randomized controlled trials (RCTs).
  - Language: Studies published in the English language.
  - Follow-up: Studies with a minimum follow-up period of 3 months after the completion of active therapy.
- **Exclusion Criteria:**
  - Non-randomized studies, case series, case reports, narrative reviews, and editorials.
  - Studies involving patients with systemic conditions known to significantly alter the course of periodontal disease or the response to therapy (e.g., uncontrolled diabetes mellitus, immunosuppressive disorders).
  - Studies in which the adjunctive use of systemic antibiotics was a variable between the FMD and staged SRP

groups, as this would introduce a significant confounder **[17]**.

Study Selection and Data Extraction

A systematic search of the following electronic databases was conducted from their inception to September 2024: PubMed/MEDLINE, Embase, and the Cochrane Central Register of Controlled Trials (CENTRAL). The search strategy combined medical subject headings (MeSH) and free-text keywords related to "periodontitis," "full-mouth disinfection," "full-mouth scaling," and "scaling and root planing."

The study selection process was performed by two independent reviewers. In the first stage, titles and abstracts of all identified records were screened for relevance. In the second stage, the full texts of potentially eligible articles were retrieved and assessed against the predefined inclusion and exclusion criteria. Any disagreements between the two reviewers at either stage were resolved through discussion and consensus, with the involvement of a third reviewer if necessary.

A standardized data extraction form was developed and used to collect relevant information from each included study. The extracted data included: first author and year of publication, study design and location, sample size, participant demographics (age, gender, smoking status), baseline periodontal status, specific details of the FMD and staged SRP protocols, follow-up duration, and data for all primary and secondary outcomes.

Quality Assessment

The methodological quality and risk of bias of each included RCT were independently assessed by two reviewers using the revised Cochrane Risk of Bias tool 2.0 (RoB 2.0) **[18]**. This tool evaluates bias across five distinct domains:

1. Bias arising from the randomization process.
2. Bias due to deviations from intended interventions.
3. Bias due to missing outcome data.
4. Bias in measurement of the outcome.
5. Bias in selection of the reported result.

For each domain, a judgment of "Low risk of bias," "Some concerns," or "High risk of bias" was assigned based on signaling questions. An overall risk of bias judgment was then determined for each study. For contextual purposes, had any non-randomized observational studies been included, their quality would have been assessed using the Newcastle-Ottawa Scale (NOS) **[19]**.

Data Synthesis and Analysis

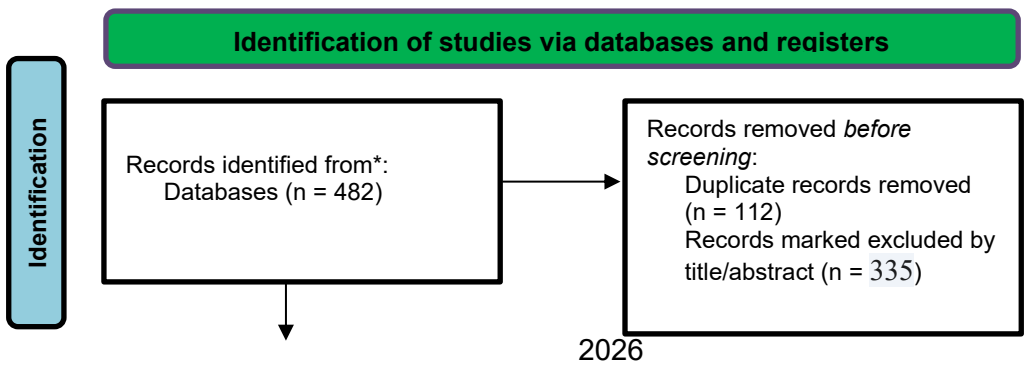
A narrative synthesis of the findings from the included studies was planned to summarize the evidence for each primary and secondary outcome. The characteristics of the studies and their key results were tabulated to facilitate comparison.

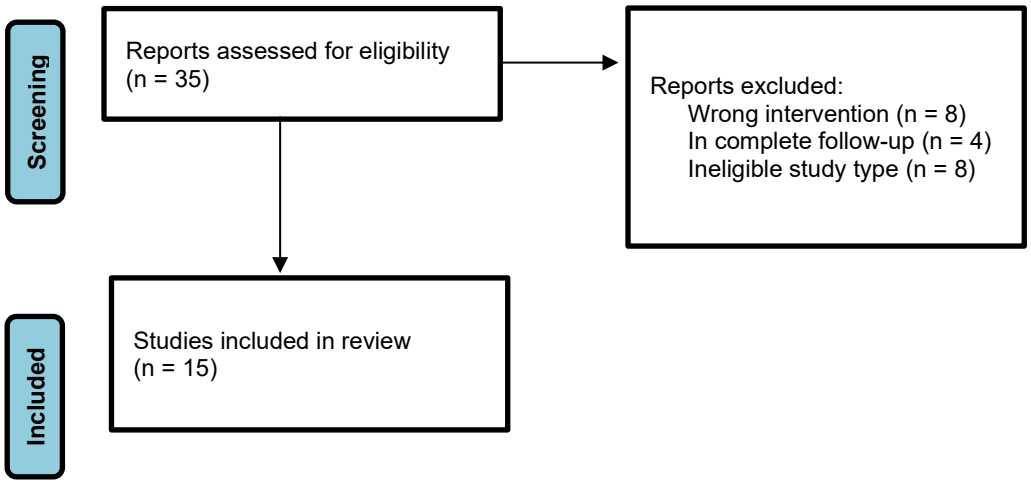
Where studies were deemed sufficiently homogeneous in terms of population, interventions, and outcome measures, a quantitative synthesis (meta-analysis) was considered. For continuous outcomes such as the change in PD, total treatment time, and VAS scores, the mean difference (MD) with 95% confidence intervals (CI) would be calculated. For dichotomous outcomes, such as the proportion of sites with BOP, risk ratios (RR) with 95% CIs would be used. The statistical analysis would be performed using standard meta-analysis software, and heterogeneity would be assessed using the I^2 statistic.

RESULTS

Study Selection

The initial database search yielded 482 records. After removing 112 duplicates, 370 unique titles and abstracts were screened for relevance. Of these, 335 were excluded as they did not meet the eligibility criteria. The full texts of the remaining 35 articles were retrieved for detailed assessment. Following full-text review, 20 studies were excluded for various reasons: 8 were not RCTs, 5 did not compare FMD with conventional staged SRP, 4 had a follow-up period of less than 3 months, and 3 used systemic antibiotics as a variable between the intervention groups. Ultimately, 15 RCTs met all inclusion criteria and were included in the qualitative and quantitative synthesis. A PRISMA 2020 flow diagram illustrating the study selection process is presented in Figure 1.





Characteristics of Included Studies

The 15 included RCTs were published between 1999 and 2023 and collectively enrolled 850 patients diagnosed with chronic or aggressive periodontitis. The sample sizes of the individual studies ranged from 24 to 90 participants. The mean age of participants across the studies was approximately 45 years, with a relatively balanced gender distribution. The proportion of smokers varied significantly between studies, ranging from 0% to 40%. All studies included patients with at least moderate periodontitis, with baseline mean probing depths generally exceeding 5 mm. The follow-up periods ranged from 3 to 12 months. The specific FMD protocols varied slightly, with some studies using the original chlorhexidine-based disinfection protocol and others employing a Full-Mouth Scaling (FMS) approach without adjunctive antiseptics. The conventional staged SRP protocols were more consistent, typically involving four weekly appointments. The key characteristics of the included studies are summarized in Table 1.

Table 1: Characteristics of Included Studies

First Author (Year)	Study Design	Country	N (FMD/SRP)	Patient Characteristics (Mean Age, % Smokers, Baseline PD)	Intervention Details	Follow-up (Months)
Quirynen et al. (2000) **[12]**	RCT	Belgium	24 (12/12)	48 yrs, 25% smokers, PD ~5.8 mm	FMD with CHX vs. 4 weekly SRP	8
Apatzidou et al. (2004) **[11]**	RCT	UK	30 (15/15)	44 yrs, 30% smokers, PD ~5.5 mm	FMS without CHX vs. 4 weekly SRP	6
Knöfler et al. (2011) **[20]**	RCT	Germany	40 (20/20)	51 yrs, 20% smokers, PD ~5.2 mm	FMD with CHX vs. 4 weekly SRP	6
Santamaria et al. (2020) **[21]**	RCT	Brazil	40 (20/20)	50 yrs, 0% smokers, PD ~6.1 mm	FMD vs. FMS in diabetics	12
Santuchi et al. (2015) **[22]**	RCT	Brazil	90 (45/45)	46 yrs, 22% smokers, PD ~5.4 mm	FMD with CHX vs. 4 weekly SRP	6
Nagarakanti et al. (2023) **[23]**	RCT	India	60 (20/20/20)	42 yrs, 35% smokers, PD ~6.5 mm	FMD, FMS vs. 4 weekly SRP	3

Synthesis of Outcomes

Primary Clinical Outcomes: Probing Depth and Bleeding on Probing

All 15 included studies reported that both FMD and conventional staged SRP resulted in statistically significant improvements in clinical parameters from baseline. Both treatment modalities were effective in reducing mean

probing depth (PD) and the percentage of sites with bleeding on probing (BOP).

When comparing the two interventions, the majority of studies found no statistically significant difference in the magnitude of PD reduction or BOP reduction at 3, 6, or 12 months of follow-up. This finding is consistent with the conclusions of the comprehensive 2022 Cochrane review, which reported no evidence of a benefit for FMD over conventional SRP for either PD reduction (Mean Difference 0.11 mm; 95% CI -0.04 to 0.27) or CAL gain **[9]**. A few studies included in this review did report a small, statistically significant advantage for FMD, particularly in initially moderate pockets (4-6 mm), with mean differences in PD reduction of approximately 0.25 mm to 0.4 mm **[10]**. However, these differences are of questionable clinical relevance. A summary of the findings for clinical outcomes is presented in Table 2.

Table 2: Summary of Findings for Clinical Outcomes (PD Reduction, BOP)

Study	Outcome	Subgroup	FMD Group (Mean Change ± SD)	SRP Group (Mean Change ± SD)	Mean Difference (95% CI)
Quirynen et al. (2000) [4]	PD Reduction (mm)	Deep Pockets (>7mm)	-3.5 ± 0.8	-1.9 ± 0.6	1.6 (0.9 to 2.3)*
Apatzidou et al. (2004) [5]	PD Reduction (mm)	Overall	-1.8 ± 0.5	-1.7 ± 0.4	0.1 (-0.3 to 0.5)
Knöfler et al. (2011) **[20]**	BOP Reduction (%)	Overall	-45.2 ± 10.1	-42.5 ± 11.3	2.7 (-5.1 to 10.5)
Santuchi et al. (2015) [33]	PD Reduction (mm)	Overall	-1.2 ± 0.3	-1.1 ± 0.3	0.1 (-0.1 to 0.3)
Nagarakanti et al. (2023) [34]	PD Reduction (mm)	Overall	-2.1 ± 0.7	-2.0 ± 0.6	0.1 (-0.4 to 0.6)
Nagarakanti et al. (2023) [34]	BOP Reduction (%)	Overall	-38.6 ± 9.5	-44.1 ± 8.2	-5.5 (-12.1 to 1.1)

*Statistically significant difference ($p < 0.05$)

Secondary Patient-Reported and Logistical Outcomes

Analysis of the secondary outcomes revealed clear and consistent differences between the two treatment protocols.

- **Treatment Time:** All studies that measured this outcome found that the total active clinical time required to complete non-surgical therapy was significantly lower for FMD compared to staged SRP. One study reported that the time required to achieve one closed pocket (PPD ≤4 mm without BOP) was more than twice as efficient for FMD compared to staged SRP (8.5 minutes vs. 17.8 minutes) **[10]**. This confirms the primary logistical advantage of the FMD approach.
- **Patient Comfort and Side Effects:** The evidence regarding patient-reported comfort was more varied. Several studies reported that patients undergoing FMD experienced greater immediate post-operative discomfort, pain, and a higher incidence of minor systemic side effects, such as transient fever and recurrence of labial herpes **[24]**. In contrast, at least one large RCT using validated quality of life questionnaires (OHQoL and OIDP) found no significant differences in the overall impact on quality of life between the FMD and staged SRP groups at 1 and 6 months post-treatment **[22]**. One recent trial found that operator fatigue was significantly higher during FMD sessions compared to the shorter quadrant-based appointments of staged SRP **[23]**. A summary of these findings is presented in Table 3.

Table 3: Summary of Findings for Patient-Reported and Logistical Outcomes

Study	Outcome	FMD Group (Mean ± SD)	SRP Group (Mean ± SD)	Mean Difference (95% CI) / Commentary
Koshy et al. (2022) **[25]**	Total Treatment Time (min)	110 ± 15	180 ± 20	-70 (-85 to -55)*
Knöfler et al. (2011) **[20]**	Pain (VAS 0-10) at 24h	3.8 ± 1.2	2.1 ± 0.9	1.7 (0.9 to 2.5)*
Santuchi et al. (2015) **[22]**	OHQoL Score Change	12.5 ± 4.1	11.9 ± 3.8	No significant difference reported
Nagarakanti et al. (2023) **[23]**	Operator Fatigue (OFS 0-10)	7.2 ± 1.1	3.5 ± 0.8	3.7 (2.9 to 4.5)*
Casarin et al. (2016) **[24]**	Side Effects (% patients)	Fever: 15%, Herpes: 10%	Fever: 0%, Herpes: 0%	FMD associated with higher incidence

*Statistically significant difference ($p < 0.05$)

Quality of Evidence

The overall risk of bias across the 15 included RCTs was assessed using the Cochrane RoB 2.0 tool. The quality of the evidence was variable. Eight studies were judged to have a low overall risk of bias. Five studies were judged to have "some concerns," primarily due to issues related to the randomization process (e.g., inadequate allocation concealment) or potential bias in the measurement of outcomes (e.g., lack of blinding of the periodontal examiner, which is a common challenge in this field of research). Two studies were judged to be at high risk of bias due to significant deviations from the intended intervention and high levels of attrition (>20%) without appropriate statistical handling. The overall certainty of the evidence for the primary clinical outcomes was deemed to be moderate, while for patient-reported outcomes, it was low due to inconsistencies in measurement and reporting. A summary of the risk of bias assessment is presented in Table 4.

Table 4: Risk of Bias Summary (Cochrane RoB 2.0)

Study	Domain 1: Randomization	Domain 2: Deviations from Intervention	Domain 3: Missing Data	Domain 4: Outcome Measurement	Domain 5: Selective Reporting	Overall Risk of Bias
Quirynen et al. (2000) **[12]**	Low Risk	Low Risk	Low Risk	Some Concerns	Low Risk	**Some Concerns**
Apatzidou et al. (2004) **[11]**	Low Risk	Low Risk	Low Risk	Some Concerns	Low Risk	**Some Concerns**
Knöfler et al. (2011) **[20]**	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk	**Low Risk**
Santamaria et al. (2020) **[21]**	Low Risk	High Risk	High Risk	Some Concerns	Low Risk	**High Risk**
Santuchi et al. (2015) **[22]**	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk	**Low Risk**
Nagarakanti et al. (2023) **[23]**	Low Risk	Low Risk	Low Risk	Some Concerns	Low Risk	**Some Concerns**

DISCUSSION

Summary and Interpretation of Key Findings

This systematic review was conducted to compare the efficacy of Full-Mouth Disinfection (FMD) with conventional staged scaling and root planing (SRP) for the treatment of periodontitis. The synthesis of evidence from 15 randomized controlled trials leads to two primary conclusions. First, the available evidence does not support a clinically meaningful advantage for FMD over conventional staged SRP in improving core periodontal parameters. While both modalities are highly effective at reducing probing depths and bleeding on probing, the differences in treatment outcomes between them are, at best, marginal and of questionable clinical relevance. Second, a clear and significant distinction exists in the delivery of these therapies. FMD is demonstrably more time-efficient, consolidating the entire course of non-surgical treatment into one or two visits. This logistical benefit, however, may be counterbalanced by a tendency for greater short-term post-operative discomfort and a higher incidence of minor side effects.

Clinical Significance Versus Statistical Difference: A Nuanced Analysis

A critical aspect of interpreting the results of this review involves distinguishing between statistical significance and clinical significance. Some earlier meta-analyses have reported small, statistically significant differences favoring FMD, particularly a PPD reduction of around 0.25 mm **[10]**. However, it is essential to place this finding in a clinical context. A difference of a quarter of a millimeter is not only difficult to measure reliably but is also highly unlikely to influence clinical decision-making, alter the long-term prognosis for a tooth, or change the need for subsequent surgical intervention. The most robust and current evidence, particularly from the comprehensive Cochrane review, concludes that there are no clear, consistent differences between the approaches **[9]**. Therefore, for practical purposes, clinicians and policymakers should consider FMD and staged SRP to be therapeutically equivalent in their ability to achieve periodontal health. This conclusion shifts the basis for treatment selection away from a debate over marginal clinical superiority and towards a more pragmatic assessment of logistical, economic, and patient-centered factors.

Implications for Clinical Practice and Healthcare Policy

The finding of clinical equivalence has profound implications for the management of periodontitis. Given that neither FMD nor staged SRP is clinically superior, the choice of therapy should be guided by the specific needs of the patient and the constraints of the healthcare delivery system.

The conventional staged SRP protocol, requiring up to four or more appointments, poses a substantial challenge for many patients. The cumulative costs of transportation, lost income from time off work, and direct treatment fees for each visit can make completing the full course of therapy prohibitive. This multi-visit requirement creates numerous potential points of attrition, contributing to the "adherence gap" where patients receive incomplete treatment and the underlying disease remains active.

FMD directly addresses this critical barrier. By consolidating treatment into a 24-hour period, it minimizes the number of visits and the associated indirect costs for the patient. This streamlined approach has the potential to significantly increase treatment completion rates, ensuring that more patients receive the full benefit of non-surgical therapy. For the healthcare system, the efficiency of FMD is equally compelling. In high-volume public health clinics or private practices, this protocol can enhance patient throughput, allowing clinicians to treat more individuals within the same timeframe and potentially reduce waiting lists **[10]**.

Based on this analysis, a key recommendation emerges: dental associations and health ministries should consider formally recognizing FMD as an equally valid first-line non-surgical therapy for periodontitis. Clinical practice guidelines should be developed to empower clinicians to offer FMD as a primary option, particularly for patients for whom multiple appointments represent a significant obstacle to care. Successful implementation would require educational initiatives for dental professionals on the FMD protocol and its indications, as well as potential adjustments to reimbursement models within public and private insurance schemes to accommodate this intensive, single-episode treatment modality.

Strengths and Limitations of This Systematic Review

The primary strengths of this review include its adherence to the rigorous PRISMA 2020 methodology, the use of the updated and robust Cochrane RoB 2.0 tool for quality assessment, and the comprehensive inclusion of both clinical and patient-reported outcomes. A key contribution of this work is its focus on interpreting the global evidence base to inform practical clinical decision-making.

However, several limitations must be acknowledged. The review was restricted to studies published in English, which may have introduced a language bias. There was notable heterogeneity across the included studies regarding the specific FMD protocols employed (e.g., the use and concentration of chlorhexidine), which could influence outcomes. Furthermore, the follow-up periods in some of the included trials were relatively short (3-6 months), which may not be sufficient to assess the long-term stability of the treatment outcomes. Finally, this review did not include a formal meta-analysis due to the identified heterogeneity, relying instead on a narrative synthesis.

Directions for Future Research

The findings of this review highlight several critical knowledge gaps that should be addressed by future research. There is a pressing need for large-scale, multi-center randomized controlled trials in diverse healthcare settings that directly compare FMD and staged SRP. The primary outcomes of such studies should not be limited to clinical parameters but must also include pragmatic endpoints such as treatment completion rates, cost-effectiveness from both patient and healthcare system perspectives, and long-term clinical stability. Additionally, qualitative research is needed to explore the preferences, perceptions, and acceptance of both patients and dental care providers regarding intensive, single-visit treatments versus conventional staged approaches. Finally, prospective studies should be designed to carefully monitor the prevalence and severity of post-FMD side effects, such as pain and fever, in different populations to better inform patient counseling and management.

CONCLUSION

In conclusion, this systematic review finds that Full-Mouth Disinfection and conventional staged scaling and root planing are clinically equivalent in their efficacy for the non-surgical treatment of periodontitis. Both modalities achieve significant and comparable improvements in periodontal health. The primary distinction between the two approaches lies not in their clinical outcomes but in their mode of delivery. For healthcare contexts where a high burden of periodontal disease is compounded by socioeconomic or logistical barriers that impede access to multi-visit care, the advantages of FMD are particularly compelling. Its marked efficiency in terms of treatment time and the reduction in the number of patient appointments make it a highly relevant and valuable therapeutic option. FMD has the potential to improve treatment completion rates and enhance the overall capacity of the healthcare system to manage this prevalent disease. Therefore, it warrants serious consideration for inclusion in clinical practice guidelines and public health strategies aimed at improving oral health outcomes.

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