e-ISSN - 2582-7855
https://doi.org/10.53274/IJCRD.2026.7103

Review

Long-Term Clinical Effectiveness of Topical Chlorhexidine as an Adjunct to Non-Surgical Periodontal Therapy: A Narrative Review

Sara Khan[1]*, Abuzar Shaikh[2], Laiba Khan[3]
[1,2]Guru Gobind Singh College of Dental Sciences and Research Centre, Burhanpur, India; [3]DY Patil Medical College, Pune

0009-0006-5143-0280[1]
0009-0002-2694-5320[3]

Received - 18-03-2026
Accepted - 15-05-2026

Address for correspondence:
Dr. Sara Khan*

sarahkhan6070@gmail.com

Abstract

Background: Mechanical debridement is the cornerstone of non-surgical periodontal therapy. Chlorhexidine (CHX), delivered as a mouthrinse, gel, or by subgingival irrigation, is commonly prescribed adjunctively, but its long-term clinical effectiveness remains unclear.
Aim: To evaluate whether CHX adjunctive to scaling and root planing (SRP) improves healing, plaque control, or microbial reduction, using probing depth (PD) and clinical attachment level (CAL) as primary clinical outcomes.
Methods: A structured literature search (1998–2024) of PubMed, Embase, and Cochrane Central identified studies assessing CHX (mouthrinse, gel, subgingival irrigation) adjunctive to SRP. Ten reports were included: four randomized controlled trials, two systematic reviews, one narrative review, two clinical studies, and one meta-analysis reporting clinical periodontal outcomes with follow-up.
Results: Adjunctive CHX (mouthrinse or gel) improves plaque control and produces statistically significant short-term reductions in bleeding on probing. However, consistent long-term improvements in PD reduction and CAL gain compared with SRP alone were not demonstrated. Subgingival CHX gel or irrigation provided minor early clinical benefits that diminished over time. Overall, additional long-term benefit beyond SRP alone was limited.
Conclusions: CHX adjunctive to SRP may reduce plaque and gingival inflammation in the short term but offers limited evidence for lasting PD or CAL improvements. CHX remains useful in specific situations post-operative care, patients with poor mechanical plaque control, or those unable to perform adequate oral hygiene—but effective mechanical debridement and regular maintenance are the primary determinants of long-term periodontal stability.

Keywords: Chlorhexidine, Periodontitis, Scaling and root planing, Non-surgical periodontal therapy, Adjunctive therapy, Probing depth , Clinical attachment level

How to cite: Khan S,Shaikh A,Khan L.Long-Term Clinical Effectiveness of Topical Chlorhexidine as an Adjunct to Non-Surgical Periodontal Therapy: A Narrative Review Ind J Clin Res Dent.2025; Jan-Jun:6 (2):14-19

Introduction

Periodontitis is a dysbiosis-driven inflammatory disease characterized by connective tissue attachment loss and alveolar bone destruction. SRP reduces microbial burden but does not fully eliminate subgingival pathogens, particularly in anatomically complex sites. Mechanical debridement may not completely eradicate the putative periodontal pathogens due to the ability of these microorganisms to

invade gingival tissues or reside in deeper areas that are inaccessible to periodontal instruments.[1] In addition, microorganisms present in other niches of the oral cavity may contribute to recolonization of periodontal pockets, potentially leading to recurrence of chronic periodontitis. Chlorhexidine, a cationic bisbiguanide with broad spectrum antimicrobial activity and high substantivity, remains the most widely prescribed oral antiseptic in periodontal therapy. It binds to hydroxyapatite and soft tissues and is gradually released over time, thereby inhibiting bacterial recolonization.

In the early 1970s, chlorhexidine gluconate was incorporated at a concentration of 0.2% into mouthrinses in Europe, and in 1986 it was introduced at a concentration of 0.12% in mouthrinses in the United States. These formulations demonstrated effectiveness in reducing supragingival microbial flora, possessed a high safety margin, and showed no evidence of bacterial resistance. Consequently, chlorhexidine emerged as a promising agent for local drug delivery systems.[2] It has been observed that the local route of drug delivery can attain antimicrobial concentrations in subgingival sites up to 100-fold higher than those achieved with systemic drug regimens.[3]

While short-term reductions in plaque accumulation and gingival inflammation are consistently demonstrated, it remains unclear whether topical chlorhexidine provides meaningful improvements in structural periodontal outcomes beyond six months, particularly in the context of structured supportive periodontal therapy. However, the available evidence remains inconclusive due to variations in the type of chlorhexidine used, method of delivery, follow-up period, and clinical parameters assessed. Most studies mainly report short-term improvements in plaque control and gingival inflammation, while evidence regarding long-term benefits in PD reduction, CAL gain, and periodontal stability remains limited. Therefore, further evaluation of the long-term effectiveness of topical chlorhexidine as an adjunct to non-surgical periodontal therapy is needed.

Methods

We conducted a narrative review using structured searches of PubMed and Google Scholar. Search terms included “periodontitis,” “scaling and root planing chlorhexidine,” “chlorhexidine mouthwash,” “chlorhexidine gel,” “chlorhexidine irrigation,” and “adjunctive periodontal therapy.”. Additional searches targeted terms such as “subgingival irrigation,” “local drug delivery,” “periodontal pocket,” and “antimicrobial mouthrinse”. Boolean operators (AND,OR) were used to combine search terms during the literature search. Two reviewers independently screened the titles and abstracts of identified studies for relevance. Articles meeting the inclusion criteria were subsequently reviewed and assessed for eligibility.

Inclusion criteria comprised randomized controlled trials, controlled clinical trials, systematic reviews, and meta-analyses evaluating the adjunctive use of topically applied chlorhexidine (mouthrinse, gel, or irrigation) in combination with scaling and root planing for the management of periodontitis. Studies published between the years 1998 to 2024 were included. Studies were required to report clinical periodontal outcomes including plaque index, gingival index, bleeding on probing, probing pocket depth, or clinical attachment level, with particular emphasis on follow-up periods of more than 4 weeks. Animal studies, case reports, studies lacking follow up date, and non-English publications were excluded.

Data extraction focused on study design, population characteristics, sample size, chlorhexidine formulation and delivery method, follow-up duration, and reported periodontal outcomes. Findings were synthesized qualitatively to assess the long-term clinical effectiveness of topical chlorhexidine as an adjunct to mechanical periodontal therapy. The methodological quality of included studies was assessed qualitatively based on study design, sample size, duration of follow up, and clarity of reported clinical outcome.

Results

Plaque and Gingival Outcomes

Several included studies showed that adjunctive chlorhexidine use consistently demonstrated reductions in supragingival plaque accumulation, reflecting its established antiplaque activity. Several studies also reported decrease in BOP, indicating improvement in gingival inflammation during the early phases of treatment. However, these benefits were generally modest and were not consistently sustained over longer follow-up periods.

Probing Depth Reduction

At follow-up periods of six months or longer, most trials evaluating adjunctive chlorhexidine (CHX) in combination with scaling and root planing (SRP) reported no statistically significant additional probing depth (PD) reduction. In instances where differences were observed, the magnitude of improvement was generally small, typically not exceeding 0.3–0.4 mm, and results were inconsistent across studies and pocket depths. Deep periodontal pockets (≥6 mm) did not consistently demonstrate enhanced clinical response with adjunctive CHX use. Meta-analytic evidence suggests that the adjunctive use of CHX mouthrinse with SRP may produce slightly greater PD reduction than SRP alone; however, clinicians must weigh this modest improvement against the negligible effect on CAL and potential adverse effects such as tooth staining when considering CHX as an adjunctive therapy for chronic periodontitis.[4]

Another published study showed PPD reduction of 33.66%, from 5.08 ± 1.23 down to 3.37±1.31 on day 30. [3] The overall mean reduction in PPD scores from baseline to 3 months with use of 0.2% CHX was 4.21 ± 0.26 mm (P < 0.00) in an RCT.[1]

chlorhexidine mouthrinse used with scaling and root planing produces negligible or no additional CAL gain compared with mechanical therapy alone.[5] In another study, the percentage gain in CAL was 15.96% and 16.78% in control and test sites, respectively. The difference in CAL in between the groups at different time points was found to be not significant statistically. Combinations of SRP with assorted adjuncts resulted in a range of average CAL improvements between 0.2 and 0.6 mm over SRP alone.[6] Systematic review evidence suggests that adjunctive subgingival chlorhexidine gel may provide slight improvements in probing pocket depth, but CAL gain was generally limited and inconsistent across studies.[5]

Subgingival Delivery Systems

Trials evaluating the adjunctive use of subgingival chlorhexidine (CHX) gel or irrigation during non-surgical periodontal therapy generally report modest clinical improvements. Several studies demonstrated reductions in PPD during the initial healing phase following treatment, typically within the first three months. However, systematic review evidence indicates that these improvements are usually small in magnitude and are not consistently maintained at longer follow-up periods.

In many cases, clinical outcomes at six to nine months were comparable to those achieved with mechanical therapy alone during routine periodontal maintenance. Furthermore, repeated local delivery protocols did not demonstrate a clear cumulative therapeutic advantage over conventional scaling and root planing alone. Adjunctive subgingival administration of CHX gel may therefore provide slight short-term improvements in PD reduction, although the long-term clinical benefit remains limited and inconsistent across studies.[5,7]

Study	Intervention	Follow-up	PD reduction (mm)	CAL gain (mm)	Main Outcome
Bannerjee, Aditya[1]	0.2% CHX mouthwash	3 months	4.21 ± 0.26	3.00 ± 0.25	No significant additional benefit
Rai R[3]	CHX mouthwash	3 months	4.10 ± 1.30	3.65 ± 1.48	Significant clinical improvement
Singh, Dhirendra Kumar[7]	CHX chip	2 months	4.77 ± 0.68	6.2 ± 1.1	Improvement in CAL

**CHX – Chlorhexidine, PD – probing depth, CAL – clinical attachment level*

Table 1. Clinical outcomes of adjunctive chlorhexidine therapy

Similarly, systematic review evidence indicates that adjunctive subgingival administration of xanthan-based chlorhexidine (XAN-CHX) gel during non-surgical periodontal therapy may provide slight additional benefits in probing pocket depth (PPD) reduction compared with non-surgical therapy alone, although these improvements remain limited in magnitude.[5]

Clinical Attachment Level

Meta-analytic evidence indicates that adjunctive

Discussion

Antimicrobial Suppression and Structural Periodontal Healing

Two-week treatment with a 0.1% chlorhexidine mouthwash was shown to produce a modest reduction in gingival inflammation associated with periodontitis. Microbiological analysis showed a significant decrease in Gram-negative facultative anaerobes and microaerophiles, accompanied by an increase in Gram-positive cocci.[8] A randomized split-mouth clinical trial involving patients with stage III periodontitis evaluated the efficacy of subgingivally delivered 1% chlorhexidine gel as an adjunct to scaling and root planing. Significant improvements were observed in clinical parameters including gingival index, modified sulcular bleeding index, and PPD over a 6-week follow-up period. Additionally, a reduction in Porphyromonas gingivalis levels was reported following treatment, indicating the short-term antimicrobial benefits of locally delivered chlorhexidine in periodontal therapy.[9]

Despite these effects, long-term structural periodontal healing depends largely on sustained control of the subgingival microbial ecosystem rather than temporary antimicrobial suppression alone. The limited long-term effectiveness of chlorhexidine may partly be explained by the increased resistance of periodontal biofilms to antimicrobial agents. García-Caballero et al. demonstrated that plaque-like biofilm exhibited significantly greater resistance to 0.2% chlorhexidine compared with salivary flora following a single mouthrinse. Although chlorhexidine demonstrated substantivity within the biofilm environment for up to 5–7 hours, antimicrobial activity remained incomplete within biofilm-associated microorganisms.[10]

Furthermore, studies evaluating oral biofilms have shown that although chlorhexidine exposure initially reduces viable bacterial cell concentrations, rapid microbial regrowth may subsequently occur, with bacterial levels eventually returning to baseline values. This recurrent recolonization may contribute to the limited sustained clinical improvements observed following adjunctive chlorhexidine therapy in periodontitis patients.[8,11]

Maintenance Effect Dilutes Adjunctive Benefit

Several studies evaluating adjunctive chlorhexidine therapy in conjunction with scaling and root planing reported only modest additional clinical improvements compared with mechanical therapy alone. Meta- analytic evidence indicates that adjunctive chlorhexidine mouthrinse may result in slightly greater PD reduction than scaling and root planing alone; however, the magnitude of this improvement was small and did not translate into meaningful CAL gain.[4] A clinical study result showed that over 3 months of extended use of CHX mouth rinse after SRP showed slightly but statistically significant better results in PD and CAL gains.[12] Similarly, systematic review evidence suggests that adjunctive subgingival chlorhexidine gel may provide slight improvements in PPD reduction during non-surgical periodontal therapy, although the overall magnitude of benefit remained limited across studies.[5] Although initiated by microbial dysbiosis, the progression and severity of periodontitis are largely determined by an exaggerated and unresolved host immune response, marked by excessive pro-inflammatory cytokine production, osteoclastogenesis, and failure of inflammation resolution pathways [13]. As chlorhexidine primarily targets microbial load without directly modulating these host inflammatory pathways, its long-term effects on structural periodontal healing remain limited.

Adverse Effects and Limitations of Long-Term Chlorhexidine Use

Long-term chlorhexidine use is associated with several adverse effects that may negatively influence patient compliance and acceptance of therapy. The most commonly reported complication is extrinsic tooth staining, particularly with prolonged mouthrinse use. Additional adverse effects include transient taste alteration, oral mucosal irritation, and increased supragingival calculus formation. Although these complications are generally reversible and non-serious, they should still be considered when prescribing chlorhexidine as an adjunctive periodontal therapy.

Where Might Chlorhexidine Still Be Justified?

A few studies demonstrated statistically significant additional PD reduction with adjunctive CHX therapy, even so, the observed improvements were modest in magnitude and may be of limited clinical relevance. While the long-term clinical implication of CHX remains limited, short-term use may still be justified in specific clinical situations. Temporary administration may be beneficial in patients with inadequate plaque control during the early healing phase following periodontal therapy. Chlorhexidine may also serve as a supportive measure in circumstances

where effective mechanical plaque removal is temporarily compromised, such as during periods of restricted oral hygiene or following periodontal surgical procedures. In these contexts, chlorhexidine can assist in short -term plaque suppression while mechanical plaque control is re-established.

Conclusion

Adjunctive chlorhexidine therapy may provide short-term reductions in plaque accumulation and gingival inflammation when used alongside scaling and root planing. However, current evidence suggests that its additional long-term benefits on probing depth reduction and clinical attachment gain remain limited and clinically modest. Biofilm resistance, microbial recolonization, and the transient nature of antimicrobial activity may contribute to these findings. Clinically, chlorhexidine appears most beneficial as a short-term adjunct in situations where mechanical plaque control is temporarily compromised, rather than as a routine long-term periodontal therapy.

Conflict of Interest: None declared
Funding: None
Data Availability: No new data generated

Author contributions:
Conceptualization: Khan S; Formal Analysis: Khan S, Shaikh A; Investigation: Khan S; Methodology: Khan L; Original Draft: Khan S; Review and Editing: Khan S, Shaikh A, Khan L

References

1. Banerjee A, Martande S, Swathi PV, et al. Comparative evaluation of 0.2% chlorhexidine and oxygenated mouthwash as an adjunct to scaling and root planing in chronic periodontitis patients: a clinico-microbiological study. Asian J Pharm Res Health Care. 2024;16(2):152-159. doi:10.4103/ajprhc.ajprhc_25_24
2. Killoy WJ. The use of locally delivered chlorhexidine in the treatment of periodontitis. Clinical results. J Clin Periodontol. 1998;25(11 Pt 2):953-979. doi:10.1111/j.1600-051x.1998.tb02397.x
3. Rai R. A comparative evaluation of the effect of Chlosite and chlorhexidine mouthwash in the management of chronic periodontitis as an adjunct to scaling and root planing: a clinico-microbiological study. Int J Pharm Res Dev. 2013;5(9):60-66
4. Da Costa LFNP, Amaral CDSF, Barbirato DDS, et al. Chlorhexidine mouthwash as an adjunct to mechanical therapy in chronic periodontitis: a meta-analysis. J Am Dent Assoc. 2017;148(5):308-318. doi:10.1016/j.adaj.2017.01.021
5. Zhao H, Hu J, Zhao L. Adjunctive subgingival application of chlorhexidine gel in nonsurgical periodontal treatment for chronic periodontitis: a systematic review and meta-analysis. BMC Oral Health. 2020;20(1):34. doi:10.1186/s12903-020-1021-0
6. Smiley CJ, Tracy SL, Abt E, et al. Systematic review and meta-analysis on the nonsurgical treatment of chronic periodontitis by means of scaling and root planing with or without adjuncts. J Am Dent Assoc. 2015;146(7):508-524.e5. doi:10.1016/j.adaj.2015.01.028
7. Singh DK, Kumar G, Pathi J, et al. A comparative evaluation between the efficacy of scaling and root planing with local delivery of chlorhexidine gluconate and scaling and root planing alone in periodontal pocket reduction therapy. J Pharm Res Int. 2021;33(53A):67-78
8. Tenenbaum H, Luc J, Schaaf JF, et al. An 8-week randomized controlled clinical study of the use of a 0.1% chlorhexidine mouthwash by chronic periodontitis patients. J Investig Clin Dent. 2011;2(1):29-37. doi:10.1111/j.2041-1626.2010.00031.x
9. Dolly AS, Shankar PLR, Saravanan AV, et al. Subgingivally delivered spirulina gel and chlorhexidine gel in periodontitis patients: a comparative study. Indian J Dent Res. 2024;35(4):406-411. doi:10.4103/ijdr.ijdr_271_24
10. García-Caballero L, Quintas V, Prada-López I,et al. Chlorhexidine substantivity on salivary flora and plaque-like biofilm: an in situ model. PLoS One. 2013 Dec 27;8(12):e83522. doi: 10.1371/journal.pone.0083522.
11. Chatzigiannidou I, Teughels W, Van de Wiele T,et al. Oral biofilms exposure to chlorhexidine results in altered microbial composition and metabolic profile. NPJ Biofilms Microbiomes. 2020 Mar 20;6(1):13. doi: 10.1038/s41522-020-0124-3.
12. Stratul SI, Rusu D, Didilescu A, et al. Prospective

clinical study evaluating the long-term adjunctive use of chlorhexidine after one-stage full-mouth scaling and root planing. Int J Dent Hyg. 2010;8:35-40. doi:10.1111/j.1601-5037.2009.00390.x

13. Phanrungsuwan A, Huang J, Dharmaraj N,et al. Host modulation therapy in periodontitis: from established therapies to emerging technologies. Front. Immunol. 2026;17:1762187. doi: 10.3389/fimmu.2026.1762187