ORIGINAL RESEARCH PAPER
Volume - 14 | Issue - 12 | December - 2025 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

EFFECTIVENESS OF CURCUMIN AND CHLORHEXIDINE GLUCONATE IN THE PREVENTION OF PLAQUE AND GINGIVITIS : A COMPARATIVE CLINICAL STUDY

Periodontology

Dr. Farheen Kamil B.D.S(K.G.M.U),GDMO, Primary Health Centre, Tushnabad, South Andaman.

Dr. Nehil Saran Senior Resident, Department of Periodontology, Faculty of Dental Sciences, King George's Medical University, U.P., Lucknow.

Prof. (Dr.) M. Kaleem Ahmad Professor, Department of Biochemistry, King George's Medical University, U.P., Lucknow.

Prof.(Dr.) Shalini Kaushal Professor, Department of Periodontology, Faculty of Dental Sciences, King George's Medical University, U.P., Lucknow

Prof. (Dr.) Nand Lal Head &Professor, Department of Periodontology, Faculty of Dental Sciences, King George's Medical University, U.P., Lucknow.

ABSTRACT

Background: Dental plaque is the main cause of gingivitis and periodontal disease. While chlorhexidine is effective for plaque control, its side effects have prompted interest in natural alternatives like curcumin, known for its anti-inflammatory and antibacterial properties. **Aim:** To compare the effectiveness of curcumin gel, curcumin lozenges, and 2% chlorhexidine gel as adjuncts to scaling and root planing (SRP) in reducing plaque and gingival inflammation. **Methods:** Forty patients with moderate-to-severe gingivitis were divided into four groups: SRP only, SRP + curcumin gel, SRP + chlorhexidine gel, and SRP + curcumin lozenges. Plaque and Gingival Indices were recorded at baseline, 14, and 21 days. **Results:** All groups showed significant improvement ($p < 0.05$). The greatest reduction was seen with chlorhexidine gel, followed closely by curcumin gel, which demonstrated comparable anti-inflammatory efficacy. Curcumin lozenges were less effective due to lower bioavailability. **Conclusion:** Curcumin gel is an effective, safe, and natural adjunct to SRP, showing results comparable to chlorhexidine in managing plaque-induced gingivitis.

KEYWORDS

Curcumin, Chlorhexidine, Gingivitis, Plaque control, Herbal alternative

INTRODUCTION

Dental plaque is recognized to be the leading cause of gingival and periodontal disorders, which are extremely widespread across the world. Harold Loe's (1965) study established a direct correlation between gingival inflammation and plaque formation. Thus, disease prevention, which is usually accomplished mechanically, is dependent on proper plaque control[1]. However, these rely significantly on personal expertise which frequently fail, particularly in interproximal locations, necessitating the use of chemical adjuncts.

Chlorhexidine is commonly considered as the gold standard for chemical plaque management, although prolonged treatment might cause discoloration and taste changes. This has increased interest in natural alternatives.[2,3] Curcumin, the main ingredient in turmeric (Curcuma longa), has anti-inflammatory, antioxidant, and antibacterial effects, making it an attractive choice for periodontal treatment.[4,5]

This study aims to evaluate and compare the efficacy of curcumin gel ,curcumin lozenges and chlorhexidine gel as adjuncts to scaling and root planing (SRP) in the management of periodontal disease.

Objective

1. To evaluate and compare the effectiveness of curcumin gel, curcumin lozenges and chlorhexidine gel in preventing dental plaque formation and gingival inflammation.
2. To determine whether curcumin formulations(gel and lozenges) can act safe ,natural and effective alternative to chlorhexidine gel for the prevention of plaque formation and gingival inflammation.

Study Design And Methodology

A total of 40 patients were selected from the dental outpatient OPD based on the inclusion and exclusion criteria. The patients were randomly allocated into four groups, with 10 participants in each group.

Inclusion criteria consisted of patients aged 18 years to 45 years, diagnosed with moderate-to-severe gingivitis, and having at least 20 erupted teeth.

Exclusion criteria included patients who had undergone periodontal therapy within the past three months, those who had used antibiotics or antiseptic mouthwash in the same period, individuals wearing prosthetic or orthodontic appliances, lactating mothers and patients with any systemic diseases.

The participants were randomly divided into four groups based on the intervention received:

- **Group 1 (Control Group):** Received scaling and root planing (SRP) only
- **Group 2:** Received SRP along with curcumin gel
- **Group 3:** Received SRP along with 2% chlorhexidine gluconate gel
- **Group 4:** Received SRP along with curcumin lozenges

All participants were clinically examined and diagnosed in a OPD Department of Periodontology ,King Georges Medical College Lucknow(U.P) under standard chair light. Medical and dental histories, along with relevant clinical data, were recorded using a prestructured case sheets. Baseline assessment of plaque accumulation and gingival inflammation was carried out using the Plaque Index (PI) by Löe and Silness (1964)[4] and the Gingival Index (GI) by Löe and Silness (1963)[5].

Following baseline evaluation, SRP was performed for all participants. Based on group allocation, the respective adjunctive intervention (curcumin gel, curcumin lozenges and chlorhexidine gel) were administered. Standard oral hygiene instructions were given to all participants.Follow-up evaluations were conducted on the 14th and 21st days post-treatment. At each follow-up visit, PI and GI were reassessed to monitor changes in clinical parameters.

RESULTS:

Table No.1 Intragroup Comparison

PLAQUE INDEX (PI)				
	Group 1	**Group 2**	**Group 3**	**Group 4**
Baseline	2.06± 0.5	2.04 ± 0.52	2.02 ± 0.53	2.06 ±0.46
After 14 days	1.01 ±0.41	0.144 ± 0.13	0.14 ± 0.10	1.61 ± 0.37
After 21 days	0.23 ± 0.13	0.13 ±0.14	0.03 ± 0.02	0.23 ± 0.13
P-value	**0.000***	**0.001***	**0.000***	**0.000***
GINGIVAL INDEX (GI)				
	Group 1	**Group 2**	**Group 3**	**Group 4**
Baseline	2.05 ±0.52	2.01 ± 0.43	2.08 ± 0.54	2.01 ± 0.52
After 14 days	1.06 ±0.50	0.39 ± 0.44	0.11 ± 0.12	1.05 ± 0.51

After 21 days	0.49 ± 0.50	0.14 ± 0.06	0.97 ± 0.10	0.24 ± 0.27
P-value	**0.001***	**0.000***	**0.000***	**0.000***

Wilcoxon Singned Rank test for Plaque index and Gingival index. p value <0.05 means statistically significant and p value <0.01 means highly statistically significant.

Table No.2 Intergroup Comparison

Groups	Plaque index			Gingival index		
	Baseline	**14 days**	**21 days**	**Baseline**	**14 days**	**21 days**
1	11.35	14.50	13.05	11.20	13.80	13.40
2	9.65	6.50	7.95	9.80	7.20	7.60
p-value[b]	0.52	0.002*	0.052*	0.63	0.011*	0.029*
1	10.55	14.60	14.95	10.40	14.80	14.40
3	10.45	6.40	6.05	10.60	6.20	6.60
p-value[b]	0.97	0.001**	0.00**	0.97	0.00**	0.002**
1	10.40	6.10	10.50	11.05	10.75	12.75
4	10.60	14.90	10.50	9.95	10.25	8.25
p-value[b]	0.97	0.00**	1.00	0.68	0.853	0.089
p-value[a]	0.923	0.00	0.00	0.925	0.00	0.13

Means rank taken for baseline, 14 days and 21 days follow-up.

[a]**Kruskal-Wallis Test** used for the intergroup comparison of all the 4 groups for plque index and gingival index. . p value <0.05 means statistically significant and p value <0.01 means highly statistically significant.

[b] **Mann whitney test** used for pair wise comparison of plaque index and gingival index. p value <0.05 means statistically significant and p value <0.01 means highly statistically significant.

DISCUSSION

The current study evaluated the comparative efficacy of curcumin gel, 2% chlorhexidine (CHX) gluconate gel, and curcumin lozenges as adjuncts to scaling and root planing (SRP) in the management of plaque-induced gingivitis. Clinical outcomes were assessed using Plaque Index (PI) and Gingival Index (GI) over a 21-day period.

All four groups demonstrated statistically significant reductions in PI and GI scores from baseline to the 14th and 21st days, indicating the effectiveness of SRP in reducing plaque accumulation and gingival inflammation (Table no.1, ($p < 0.01$).) However, groups receiving adjunctive therapies showed superior clinical improvements compared to the control group (SRP only).

Group 3 (SRP + 2% chlorhexidine gel) showed the largest reduction in Plaque Index (PI), proving chlorhexidine's position as the gold standard in chemical plaque treatment due to its broad-spectrum antibacterial activity and substantivity [5,6]. Chlorhexidine disrupts the bacterial cell membrane, increasing its permeability and inducing intracellular leakage, eventually leading to bacterial cell death. Its cationic properties also allow it to adhere to tooth surfaces and oral tissues, resulting in long-lasting antibacterial activity.

Group 2 (SRP + curcumin gel) showed comparable reductions in both PI and their Gingival Index (GI), with a particularly significant reduction in GI, demonstrating curcumin's powerful janti-inflammatory and antioxidant properties. Curcumin reduces pro-inflammatory cytokines, including TNF-α, IL-1β, and IL-6, via limiting the NF-κB signaling pathway. Furthermore, curcumin scavenges reactive oxygen species (ROS), which reduces oxidative stress and limits periodontal tissue deterioration. These results are consistent with earlier research demonstrating the herb's effectiveness in periodontal treatment. [7–10] Anand et al., 2013; Mali et al., 2012)

Group 4 (SRP + curcumin lozenges) showed slight improvement; while statistically significant within the group, the benefits were less dramatic than those seen with topical gel applications. Curcumin lozenges decrease TNF-α production, which lowers NF-κB activation. This inhibits the transcriptional production of downstream pro-inflammatory cytokines, resulting in an anti-inflammatory effect. However, the decreased bioavailability and limited direct interaction with gingival tissues compared to gel formulations may restrict the local therapeutic concentration of curcumin, explaining the considerably milder clinical consequences

On intergroup comparison(Table no2), There was highly significant reduction in plaque index at 14 and 21 days of interval in all the four groups. Gingival index (Table no 2) was significantly reduced in group 2 (SRP + Curcumin gel),group 3(SRP + 2% Chlorhexidine gel), at 14 and 21 days of interval.are supported by a 2021 trial by Desai et al., which found no significant difference between curcumin gel and 0.2% chlorhexidine gel when used subgingivally in patients with chronic periodontitis. Similar result were found by authors[12,13,14]. However, not all studies support curcumin's equivalence to CHX. A randomized trial by Tandon et al. (2020), using a single application of curcumin gel, found only mild clinical improvement, suggesting that dosage, frequency, and sustained delivery play crucial roles in clinical outcomes.whereas gingival index was significantly reduced for group 4(SRP+ Lozenges) at 14 day and there was no significant reduction at 21 day. This may be due to limitations in drug retention and bioavailability in the oral cavity.Innovative delivery systems such as nanocarrier-based gels and sustained-release formulations have shown promise in overcoming these limitations. A recent study in 2024 involving liposomal curcumin gel demonstrated improved clinical and biochemical outcomes in diabetic periodontitis patients, indicating that improved bioavailability and site-specific retention can significantly enhance clinical efficacy.

However, the study is not without limitations. The sample size was relatively small, and the follow-up period was limited to 21 days. Long-term studies with larger populations and microbiological assessments are warranted to better understand the sustained effects and mechanisms of curcumin in periodontal therapy.

CONCLUSION

Within the limitations of this study, it can be concluded that adjunctive use of curcumin gel and 2% chlorhexidine gel significantly enhances the clinical outcomes of scaling and root planing in patients with plaque-induced gingivitis. Curcumin gel showed clinical efficacy comparable to chlorhexidine, particularly in reducing gingival inflammation, and may serve as a safe and effective herbal alternative. Curcumin lozenges, though beneficial, were less effective than topical gel formulations, likely due to lower retention and bioavailability. Further longitudinal studies are recommended to validate these findings and establish curcumin as a mainstream adjunct in periodontal treatment.

Image 1: Armamentarium

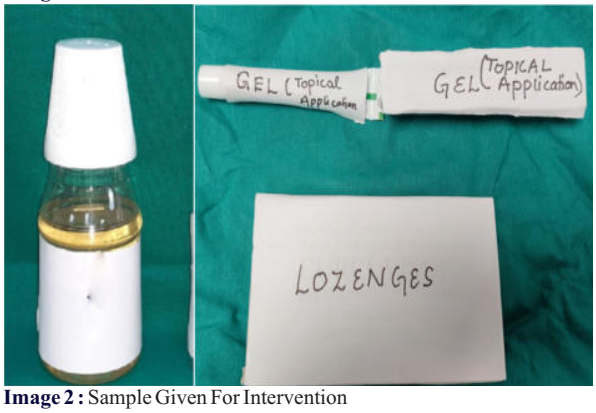
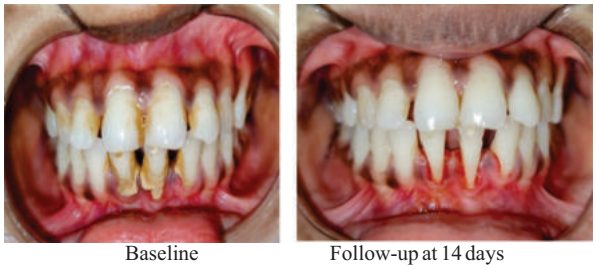
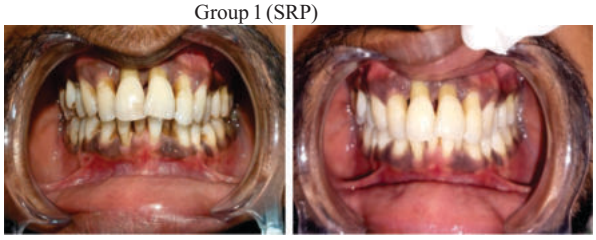


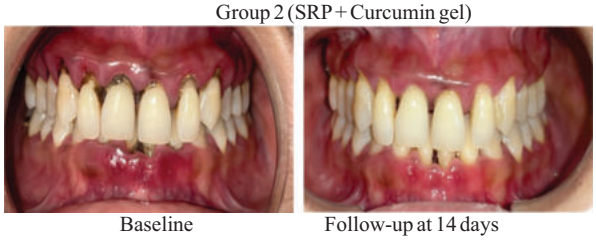
Image 2 : Sample Given For Intervention



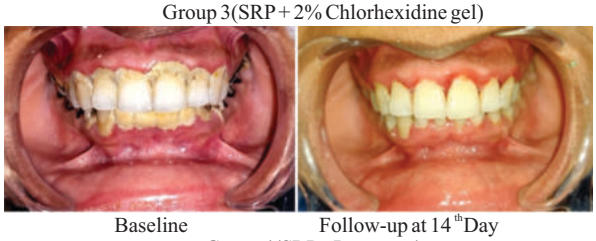
Baseline Follow-up at 14 days
Group 1 (SRP)



Baseline Follow-up at 14 days
Group 2 (SRP + Curcumin gel)



Baseline Follow-up at 14 days
Group 3(SRP + 2% Chlorhexidine gel)



Baseline Follow-up at 14 th Day
Group 4(SRP+ Lozenges)

REFERENCES

1. Wendorff-Tobolla LM, Wolgin M, Wagner G, Klerings I, Dvornyk A, Kielbassa AM. A systematic review and meta-analysis on the efficacy of locally delivered adjunctive curcumin (Curcuma longa L.) in the treatment of periodontitis. Biomedicines. 2023;11(2):481. MDPI
2. Zhang J, Huang Q, Zhang Z, De Souza Rastelli A, Yang J, Deng X. Anti-inflammatory efficacy of curcumin as an adjunct to non-surgical periodontal treatment: a systematic review and meta-analysis. J Clin Periodontol. 2022; (published online 2023). PubMed
3. (Specific RCT) Efficacy of curcumin gel as an adjunct to SRP in chronic periodontitis patients: a randomized controlled clinical trial. BMC Oral Health. 2023; (Article). BioMed CentralPubMed
4. (Liposome study) Sustained release of liposomal curcumin gel enhances periodontal outcomes in diabetic patients. Journal of Periodontal Therapy. 2023–2024; (Article). PubMed
5. James P, Worthington HV, Parnell C, Harding M, Lamont T, Cheung A, et al. Chlorhexidine mouthrinse as an adjunctive treatment for gingival health. Cochrane Database Syst Rev. 2017;(3):CD008676.
6. Van Strydonck DA, Slot DE, Van der Velden U, Van der Weijden GA. Effect of a chlorhexidine mouthrinse on plaque, gingival inflammation and staining in gingivitis patients: a systematic review. J Clin Periodontol. 2012;39(11):1042–55.
7. Chainani-Wu, N. (2003). Safety and anti-inflammatory activity of curcumin: a component of turmeric (Curcuma longa). Journal of Alternative and Complementary Medicine, 9(1), 161–168
8. Pulcini R, Chiarelli AM, Sinjari B, Esposito JE, Avolio F, Martinotti R, et al. A randomized clinical study of a curcumin and melatonin toothpaste against periodontal bacteria. Biomedicines. 2024;12(11):2499.
9. Mali AM, Behal R, Gilda SS. Nanocarrier curcumin gel and chlorhexidine gel in the treatment of periodontitis: A comparative clinical and microbiological study. J Indian Soc Periodontol. 2020;24(3):247–52.
10. Pre-clinical and clinical efficacy of curcumin as an anti-inflammatory agent for periodontitis. A systematic review. Antioxidants (Basel) or similar, 2024. PubMed
11. Tandon, R., Bhatia, N., & Mehta, A. (2020). Efficacy of a single application of curcumin gel in patients with plaque-induced gingivitis. Contemporary Clinical Dentistry, 11(4), 303–307.
12. Efficacy of curcumin gel as an adjunct to SRP in chronic periodontitis patients: a randomized controlled clinical trial. BMC Oral Health. 2023
13. Worah D, Aggarwal A, Singh P, Rajput A, Arya A. Curcumin lozenges in the management of gingivitis: a clinical study. J Clin Exp Dent. 2021;13(1):e43–7
14. Kumar, M., Dhingra, R., & Kaur, T. (2024). Efficacy of liposomal curcumin gel as a local drug delivery agent in diabetic patients with chronic periodontitis. Journal of Periodontal Research, 59(3), 123–131.
15. Singh S, Kumar BD, Verma SK, Kumari P, Singh N. Comparative Evaluation of Anti-Inflammatory Efficacy of Turmeric and Chlorhexidine Gel as an Adjunct to Scaling and Root Planing in the Treatment of Gingivitis. J Pharm Bioallied Sci. 2021 Jun;13(Suppl 1):S679-S683. doi: 10.4103/jpbs.JPBS_713_20. Epub 2021 Jun 5. PMID: 34447180; PMCID: PMC8375935.
16. Kandwal A, Mamgain RK, Mamgain P. Comparative evaluation of turmeric gel with 2% chlorhexidine gluconate gel for treatment of plaque induced gingivitis: A randomized controlled clinical trial. Ayu. 2015 Apr-Jun;36(2):145-50. doi: 10.4103/0974-8520.175537. PMID: 27011714; PMCID: PMC4784123.
17. Zhang Y, Huang L, Mazurel D, Zheng H, Yang J, Deng D. Clinical efficacy of curcumin versus chlorhexidine as an adjunct to scaling and root planing for the treatment of periodontitis: A systematic review and meta-analysis. Phytother Res. 2021 Nov;35(11):5980-5991. doi: 10.1002/ptr.7208. Epub 2021 Jul 2. PMID: 34216058.