Original Article

# Comparative Evaluation of Efficacy of Oral Curcumin Gel as an Adjunct to Scaling and Root Planing in the Treatment of Chronic Periodontitis

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## Abstract

**Background:** A large number of *in vitro* and *in vivo* studies in both animals and humans have reported that curcumin has antioxidant, anti-inflammatory, anti-carcinogenic, anti-microbial and anti-parasitic properties. *Curcuma longa* is also used externally for inflammation of oral mucosa. To overcome the adverse effects caused by the chemical agents, curcumin is proposed as an alternative for the treatment of gingivitis and periodontitis. **Aim:** This study aimed to evaluate and compare the role of topical application of oral curcumin gel with scaling and root planing (SRP) on chronic periodontitis. **Materials and Methods:** In this clinical study, forty participants with mild chronic periodontitis were included. Included participants underwent Phase I therapy, after which they were allocated into two groups (20 each), out of which only one group received curcumin gel for topical application. Plaque index (PI), bleeding on probing measured by sulcus bleeding index, probing pocket depth and clinical attachment level (CAL) were recorded at baseline and at the follow-up after 2 months. **Results:** Both test and control groups showed statistically significant reduction in PI, sulcular bleeding index, pocket probing depth and CAL. Curcumin gel group showed statistically significant difference compared to the control group with respect to PI (<0.001), sulcular bleeding index (<0.001) and pocket probing depth (0.006). **Conclusion:** Curcumin as an adjunct to SRP showed higher reduction in plaque accumulation, sulcular bleeding and pocket probing depth as compared to SRP alone.

**Keywords:** Curcumin gel, periodontitis, scaling and root planing

## Introduction

Periodontal disease is a chronic inflammatory disease characterised by destruction of the supporting structures of the teeth. The primary aetiologic factor of periodontitis is dental plaque and the microorganisms that are present in it. The biofilm nature of dental plaque provides a specialised environment for the microorganisms, thereby ensuring its vitality and pathogenicity. The aim of periodontal therapy is to remove the bacterial plaque and all the factors that favour its accumulation. The routine therapeutic modality of periodontitis is scaling and root planing (SRP). This involves the removal of supragingival and subgingival plaque and calculus, thereby returning the tissues to a state of health.[1]

Many chemical agents have been tested as adjuncts to mechanical methods which can reduce plaque-associated gingivitis. Chlorhexidine, triclosan, povidone-iodine and various phenolic compounds have been used successfully as anti-plaque agents. However, side effects such as allergy, discolouration of teeth and unpleasant taste can occur when these chemicals are used for an extended period of time.[2]

Herbal medicines have been used for thousands of years in developing countries and more than 80% of population rely on their use for healthcare needs. Turmeric, neem, aloe vera, clove and cinnamon are amongst the common herbal products used in dentistry, amongst which turmeric is a dietary spice, with curcuma as its most active ingredient. It is widely used as a traditional medicine in Asian countries. Curcuminoids are components of turmeric, which include

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Quick Response Code:

Website: www.aihbonline.com

DOI: 10.4103/AIHB.AIHB_46_17

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**How to cite this article:** Dave DH, Patel P, Shah M, Dadawala SM, Saraiya K, Sant AV. Comparative evaluation of efficacy of oral curcumin gel as an adjunct to scaling and root planing in the treatment of chronic periodontitis. Adv Hum Biol 2018;8:79-82.

mainly curcumin (diferuloylmethane), demethoxy curcumin and bisdemethoxycurcumin.[2]

A large number of studies in both animals and humans have reported that curcumin has antioxidant, anti-inflammatory, anti-carcinogenic, anti-microbial and anti-parasitic properties.[3] However, limited literature is available testing the efficacy of curcumin on pocket probing depth and clinical attachment level (CAL) in patients with mild chronic periodontitis. *Curcuma longa* is also used externally for inflammation of oral mucosa. To overcome the adverse effects caused by the chemical agents, curcumin can be employed in the management of gingivitis and periodontitis. Hence, we designed a clinical study to compare the efficacy of SRP with or without the application of oral curcumin gel on mild chronic periodontitis.

## Materials and Methods

Patients in this study were selected from the outpatient department of periodontology, K M Shah Dental College and Hospital, Piparia, Gujarat, India, after obtaining institutional ethics committee approval. Verbal and written informed consent was obtained from every participant. This clinic study with a short duration constituted of forty participants who were selected according to defined inclusion and exclusion criteria.

Systemically healthy participants suffering from mild periodontitis with a minimum of twenty natural teeth, aged between 20 and 59 years, and who had not received any periodontal treatment in the previous 6 months were included in the study. Participants who had any adverse habits, such as smoking or tobacco chewing, and who were not willing for participation and further follow-up were excluded.

Participants were randomly allocated into two groups using flip coin method: Group 1, which was the control group that included participants receiving only SRP and Group 2, which was the test group that included participants who received SRP with topical oral curcumin gel.

Clinical examination was carried out with the help of a UNC-15 periodontal probe. Plaque index (PI), bleeding on probing (BOP) which was measured by sulcus bleeding index (SBI), probing pocket depth (PPD) and CAL were recorded before each participant received initial periodontal treatment.

Following Phase 1 therapy, all participants in the test group were given curcuma gel tubes along with oral hygiene instructions. They were instructed to apply it for 2–3 min, on the site gently in circular motion once daily, and were instructed to leave the gel in the mouth for at least 10 min after application and thereafter cleanse with water to clear any residual medication.

At their follow-up visits at 1 month and 2 months, the oral hygiene instructions were reinforced and the clinical parameters, i.e., PI, BOP measured by SBI, PPD and CAL were recorded.

### Statistical analysis

The statistical analysis was performed using Student's *t*-test, paired *t*-test and independent *t*-test when appropriate.

## Results

All patients were able to complete the clinical trial. The gel did not show any adverse reactions such as ulcerations or allergic reactions. Periodontal parameters at baseline were similar in both groups [Table 1]. When compared at baseline and at final follow-up, both of the treatments showed statistically significant reduction in PI, sulcular bleeding index, pocket probing depth and CAL [Tables 2 and 3]. There was no statistically significant difference when compared between 1 month and 2 months. Intergroup analysis showed statistically significant difference with respect to PI (<0.001), sulcular bleeding index (<0.001) and pocket probing depth (0.006) in favour of the test group. The CAL when compared at 2 months' follow-up and baseline had increased in both test and control groups; although it was higher in test group, it was not statistically significant with $P = 0.117$ [Table 4].

**Table 1: Baseline values of test and control**

| Clinical parameters | Mean±SD | | *P* |
|---|---|---|---|
| | Test | Control | |
| PI | 2.6±0.498 | 2.77±0.43 | 0.171 |
| SBI | 3.03±0.49 | 3.03±0.414 | 1 |
| PPD | 4.53±0.571 | 4.53±0.507 | 1 |
| CAL | 3.2±2.007 | 3.77±1.695 | 0.242 |

PI: Plaque index, SBI: Sulcus bleeding index, PPD: Probing pocket depth, CAL: Clinical attachment level, SD: Standard deviation

**Table 2: Results in test given at different time intervals (baseline and 2 months)**

| Clinical parameters | Baseline | 2 months | *P* |
|---|---|---|---|
| PI | 2.6±0.498 | 0.37±0.556 | <0.001 |
| SBI | 3.03±0.49 | 0.83±0.379 | <0.001 |
| PPD | 4.53±0.871 | 2.67±0.479 | <0.001 |
| CAL | 3.2±2.007 | 1.97±1.273 | <0.001 |

PI: Plaque index, SBI: Sulcus bleeding index, PPD: Probing pocket depth, CAL: Clinical attachment level

**Table 3: Results in control given at different time intervals (baseline and 2 months)**

| Clinical parameters | Baseline | 2 months | *P* |
|---|---|---|---|
| PI | 2.77±0.43 | 1.27±0.45 | <0.001 |
| SBI | 3.03±0.414 | 1.67±0.479 | <0.001 |
| PPD | 4.53±0.507 | 3.33±0.884 | <0.001 |
| CAL | 3.77±1.695 | 3±1.39 | 0.002 |

PI: Plaque index, SBI: Sulcus bleeding index, PPD: Probing pocket depth, CAL: Clinical attachment level

**Table 4: Difference from baseline to final follow-up (2 months)**

| Clinical parameters | Test | Control | *P* |
|---|---|---|---|
| PI | 2.23±0.63 | 1.5±0.56 | <0.001 |
| SBI | 2.2±0.61 | 1.37±0.72 | <0.001 |
| PPD | 1.87±0.86 | 1.2±0.96 | 0.006 |
| CAL | 1.23±1.04 | 0.77±1.22 | 0.117 |

PI: Plaque index, SBI: Sulcus bleeding index, PPD: Probing pocket depth, CAL: Clinical attachment level

## Discussion

The primary objective of periodontal therapy is to reduce the microbial load, thereby leading to an improvement in the clinical parameters. SRP remains the gold standard of periodontal therapy, with numerous other agents being currently used as adjunctive therapeutic modalities. Despite the availability of a wide range of antimicrobial agents for clinical use, development of new antimicrobial agents remains important and many studies have been aiming at the discovery and development of new antimicrobial agents.[4] The combination of microorganisms and inflammatory response is the cause of many diseases, including periodontitis, for which compounds having a dual anti-inflammatory and antimicrobial activity may be desirable therapeutic agents.[5]

Curcumin (diferuloylmethane), the main yellow bioactive component of turmeric, has been shown to have a wide spectrum of biological actions.[6] Literature reports have shown that curcumin has anti-inflammatory and antibacterial activities, suggesting its potential to be used as a subgingival agent.[6] Safety evaluation studies have indicated that both turmeric and curcumin are well tolerated at a very high dose without any toxic effects.[6]

Curcumin has been shown to regulate numerous transcription factors such as cytokines, protein kinases, adhesion molecules, redox status and enzymes that have been linked to inflammation.[7] The anti-inflammatory activity of curcumin was first reported in 1971.[8] It reduces inflammation by effectively inhibiting transcriptional and translational expression of pro-inflammatory cytokines such as interleukin-6 and tumour necrosis factor-alpha. Curcumin also demonstrated dose-dependent attenuation of nuclear factor-kappa light chain enhancer of activated B-cell activation in the gingival tissue of rats suffering from experimental periodontal disease. It, further, reduces the inflammatory infiltrate, increases collagen content and increases fibroblastic cell numbers in gingival tissues.[8]

This study aimed at evaluating the effectiveness of curcumin gel when used along with SRP as a topical gel by comparing with only SRP. The results of the present study indicated the efficacy of the curcumin gel in improving the PI, sulcular bleeding index and probing depth in participants with chronic periodontitis. There was statistically significant improvement in the CAL, but on comparison with the control group, the improvement was not statistically significant.

The reduction in sulcular bleeding index and pocket probing depth can be attributed to curcumin's anti-inflammatory and wound healing capacity as suggested by Rai *et al*. Rai *et al*. suggested that curcumin may inhibit bacterial cell proliferation by inhibiting the assembly dynamics of FtsZ (a bacterial protofilament), which polymerizes to form a Z-ring at the midcell that orchesterates bacterial cell division. The assembly and stability of FtsZ protofilaments have been shown to play critical roles in bacterial cytokinesis. Thus, FtsZ may be considered as an important antibacterial drug target. It was suggested that curcumin strongly inhibited the formation of cytokinetic Z-ring, which would prove lethal to bacteria, thus accounting for curcumin's antibacterial activity.[9]

The reduction in the PI can be contributed to its antibiofilm activity, as suggested by Chusri *et al*.[10] and Savita *et al*. Savita *et al*. claimed that curcumin inhibits the production of biofilm and disperses the biofilm made by many microorganisms.[11]

There was a statistically significant improvement in PPD and CAL as well in a study done by Nagasri *et al*.,[12] in which they inserted curcumin gel as a local drug delivery agent in the selected site. In this study, we used curcumin gel as a topical gel, which might be the reason why CAL showed a better improvement in comparison to the control group, but it was not statistically significant. It can also be attributed to the short duration of the study (2 months) and small sample size. Hence, future studies with large sample size and longer duration are necessary to confirm the effects of curcumin gel in periodontal therapy.

Apart from the antibacterial property, curcumin is a molecule known to demonstrate antifungal activity[13] and antiviral activity as well.[14]

## Conclusion

Within the limits of this clinical study, it can be concluded that the oral curcumin gel was efficient in reducing plaque, gingival inflammation and subsequently probing depth at 1 month and 2 months. However, studies with a longer study period are required to determine the effect of topical curcumin gel application in improving the CAL.

### Financial support and sponsorship

Nil.

### Conflicts of interest

There are no conflicts of interest.

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