

Evaluation of Anti-plaque and Anti-inflammatory Effects of Oral Curcumin Gel as Adjunct to Scaling and Root Planing: A Clinical Study

Abstract

Context: The adverse effects associated with traditional adjunctive chemical agents in the management of gingivitis has stimulated research into search for alternate molecules including herbal products. Aims-To compare the effects of oral curcumin gel as an adjunct to scaling and root planing (SRP) with the effects achieved by SRP alone by assessing their effects on plaque, gingival inflammation and gingival bleeding. **Materials and Methods:** Sixty patients in the age group of 20–60 years were recruited employing inclusion and exclusion criteria. Study population was randomly divided into two groups. Group A-test group was instructed to use twice daily the experimental curcumin gel after initial SRP. Group B-control group received only SRP. Parameters recorded were plaque index (PI), gingival index (GI) and sulcus bleeding index (SBI) on day 0 (baseline), days 7, 14, and 21 along with subjective assessment of any reported untoward side effect. Data was analyzed statistically. **Results:** The PI, GI and SBI decreased in both the test group and control group from day 0 to day 21 consecutively. Intergroup comparison shows that all the parameters were statistically significant in Group A ($P < 0.001$) as compared to Group B. **Conclusion:** Curcumin gel has significant antiplaque and anti-inflammatory effect in the treatment of gingivitis and can be effectively employed as an adjunct to SRP.

Keywords: Curcumin gel, gingivitis, scaling and root planing

Introduction

Gingival and periodontal diseases are among the most common chronic oral diseases affecting majority of populations globally. Gingivitis is attributed to the accumulation of dental plaque and usually precedes periodontitis; which eventually may lead to tooth loss. A direct relationship has been demonstrated between plaque levels and the severity of gingivitis. A complex interplay between the pathogenic microorganisms contained in the dental plaque and host immune inflammatory system determine the establishment of periodontal diseases.^[1] The lesion of gingivitis is reversible.^[2] Although the progression from gingivitis to periodontitis is not predictable, the prevalence of gingivitis in the adult population is still the first step towards prevention of periodontitis.^[3] Mechanical debridement in the form of scaling and root planing (SRP) has remained the mainstay of periodontal treatment, together with patient reinforced oral hygiene methods. SRP is aimed to reduce the pathologic

bacterial load in the periodontal tissues to proportions manageable by the host immune system.^[4,5]

Patient compliance and accessibility to all tooth surfaces may jeopardize the results of mechanical therapy and hence, the use of adjunctive chemical agents may be of use in the management of these inflammatory conditions. Various chemical agents such as chlorhexidine, triclosan, fluorides, essential oils, quaternary ammonium compounds, and sanguinarine are available as toothpaste or in the form of gel and mouthwash. However these agents have their own limitations and side effects, for example bitter taste, oral mucosal ulceration, and brown staining of teeth.^[6]

Ayurveda, the traditional Indian system of medicine has been successfully used to treat a variety of chronic systemic ailments. Turmeric a household spice used in India possesses anti-inflammatory, antioxidant, and antimicrobial properties along with hepatoprotective, immunosuppressant, antiseptic, antimutagenic, and many more properties.^[7] Turmeric (*Curcuma longa*) is

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a member of the ginger family-Zingiberaceae, its rhizome contains an orange pulp which is the source of turmeric medicinal compounds.^[8] Components of turmeric mainly include curcumin (diferuloylmethane), dimethoxycurcumin bisdemethoxycurcumin and various volatile oils including tumerone, atlantone, and zingiberone. Curcumin the principal active ingredient has been researched the most and has demonstrated significant anti-inflammatory properties.

Curcumin has been used as a traditional medicine. In Unani, turmeric is used to expel phlegm or *kapha*, this can be attributed to its anti-inflammatory property. In order to overcome the adverse effects of chemical agents, curcumin can be employed in the management of gingivitis and periodontitis. However, little literature is available testing the efficacy of curcumin on gingival inflammation. Hence, a clinical study was designed to compare the efficacy of scaling and root planning with or without the application of oral curcumin gel in the management of gingivitis.

Materials and Methods

This was a prospective randomized study and a total of 60 individuals were selected from the outpatient department of Vananchal Dental College and Hospital, Garhwa, Jharkhand. The study was approved by the Institutional Ethical Committee and all the subjects were enrolled after obtaining written informed consent.

Inclusion criteria

Systemically healthy individuals in the age group of 20–60 years who had not received any form of periodontal treatment in the previous 6 months and with probing depth ≤ 3 mm were included in the study.

Exclusion criteria

Smokers, patients with concurrent systemic diseases or medically compromised individuals, females who were pregnant or lactating, patients on antibiotic, anti-inflammatory medications or medications for any systemic disease in the previous 3 months, patients with prosthetic or orthodontic appliance and patients with known hypersensitivity to curcumin were excluded from the study.

Sample size was calculated based on a pilot study done by Jaswal *et al.*^[9] In this pilot study sample size of 15 individuals in each group was considered., with a power = 80% and alpha = 5%, 25 subjects in each group was decided, taking 20% attrition rate, a sample of 30 subjects in each group was decided. Sixty patients satisfying the inclusion and exclusion criteria were randomly allocated into two groups. Group A (Test)-included 30 participants who received SRP with topical oral curcumin gel. Group B (Control)-included 30 participants who received SRP. Clinical examination was done using mouth mirror, explorer, UNC-15 probe, and tweezers. The following clinical parameters were recorded-plaque index (PI),^[10] gingival index (GI),^[11] sulcular bleeding index (SBI).^[12] All

these parameters were recorded before starting any form of periodontal treatment.

After completion of phase I therapy, all participants in the test group were instructed to apply curcuma oral gel twice daily after brushing with gentle circular motion and to leave it for 10 min, and thereafter to rinse with water to clear any residual medicine. Oral hygiene instructions were given and patients were recalled on day 7, 14, and 21. All clinical parameters were recorded during subsequent recall visits.

Sample was randomized using Sequentially Numbered Opaque Sealed Envelopes schemes. This was done by the distant investigator (SN) and the subjects were enrolled in the study by the clinician at the study site (VJ).

Statistical analysis was performed by calculating Student's *t*-test and paired *t*-test Results were considered to be significantly different for $P < 0.005$.

Results

All 60 patients completed the study. The experimental gel had acceptable taste and no incidence of adverse drug reaction such as burning, dryness/soreness, staining, or allergy was reported.

At baseline, all participants in both the groups had significant plaque and gingivitis score and bleeding on probing. Both the test and control group did not show any statistical significant difference with respect to PI, GI, and SBI.

Plaque index

PI reduced during the study period in both the groups. [Table 1] The percentage reduction in PI was 70 ± 6.83 in the test group and 52.26 ± 12.09 in control group. The difference was statistically significant.

Gingival index

Group A - The mean GI at baseline and 21 days follow-up was 1.93 ± 0.27 and 0.58 ± 0.09 which was statistically significant.

Group B - At baseline mean GI was 1.89 ± 0.3 and at 21 day follow-up 1.12 ± 0.48 . Intergroup comparison was statistically significant. [Table 2]

Statistically significant difference was observed in Group A as compared to Group B with mean values of 64.98 ± 11.12 and 54.01 ± 19.01 in Group A and Group B, respectively. Percentage reduction in GI was significantly more in Group A compared to Group B (62.31 ± 7.19 vs 51.19 ± 18.32).

Sulcus bleeding index

SBI reduced throughout the study period in both the groups [Table 3]. However, percentage reduction in SBI was significantly more in Group A compared to Group B (64.98 ± 11.12 vs 54.01 ± 19.01).

Table 1: Intergroup comparison of plaque index at various intervals

PI	Mean±SD	
	Group A	Group B
Baseline	1.86±0.17	1.89±0.19
7	1.40±0.16	1.63±0.2
14	1.09±0.19	1.74±0.15
21	0.53±0.07	1.16±0.42

SD: Standard deviation; PI: Plaque index

Table 2: Intergroup comparison of gingival index at baseline, 7, 14 and 21 days

GI	Mean±SD		P
	Group A	Group B	
Baseline	1.93±0.27	1.89±0.3	<0.001
7 days	1.61±0.35	1.81±0.2	<0.001
14 days	1.1±0.16	1.79±0.38	<0.001
21 days	0.58±0.09	1.12±0.48	<0.001

SD: Standard deviation; GI: Gingival index

Table 3: Intergroup analysis of sulcus bleeding index at periodic recall interval

SBI	Mean±SD	
	Group A	Group B
Baseline	2.09±0.4	2.09±0.28
7 days	1.79±0.28	1.98±0.31
14 days	1.19±0.31	1.76±0.24
21 days	0.64±0.19	1.11±0.29

SD: Standard deviation; SBI: Sulcus bleeding index

Discussion

The interplay between bacterial products with the host tissues results in inflammatory and immunological damage in the host periodontal tissues. SRP has remained gold standard of periodontal therapy; however the inability of patients to perform adequate mechanical plaque control has stimulated the search for alternate chemotherapeutic agents to improve gingivitis. The side effects of these chemicals have promoted the use of herbal products for this purpose. The anti-inflammatory activity of curcumin has been studied in various medical conditions and it has shown beneficial in the treatment of rheumatoid arthritis,^[13] irritable bowel syndrome.^[14] It also accelerates wound healing. Thus, it is prudent to explore the anti-inflammatory effect in management of gingivitis. Very few studies have been done regarding the effect of curcuma gel as adjunctive anti-inflammatory agent in the treatment of gingival and periodontal diseases. Hence, the present investigation was designed to assess the effect of oral curcuma gel in the management of gingivitis along with SRP.

In Ayurveda turmeric is considered as Tridoshahara due to its pharmacological properties. It has Lekhaniya and anti-Kapha property which attributes to its antiplaque and antigingivitis nature.^[15] This could be a possible

mechanism of the prevention of biofilm formation and co-aggregation phenomena. Its anti-inflammatory property can be suggested due to Katu Rasa.^[16] This is an important property as it helps in reducing gingival inflammatory load. In addition to these properties it has anti-Vata property which reduces periodontal pain.^[17]

Farjana *et al.*^[18] did a pilot study to evaluate the clinical efficacy of oral curcuma gel in gingivitis management without traditional SRP employing Papillary bleeding index and GI as clinical parameters and observed significant reduction in papillary bleeding index.

The anti-inflammatory properties of two components of turmeric (total petroleum ether extract of the rhizome of turmeric) was compared with hydrocortisone and phnylbutazone by Arora^[19] and he reported significant reduction in inflammation.

Curcumin, has documented antimicrobial activity and may be useful for controlling dental biofilms.^[20] Izui *et al.*^[21] studied the antibacterial activity of curcumin against periodontopathic bacteria and observed that curcumin can inhibit the growth of *P. Gingivalis*, *P. intermedia*, *F. nucleatum* and *T. denticola* in a dose dependent manner. Curcumin may also delay the disease process of periodontitis in its initial stages. It has been shown to suppress NF- χ B pathway in human gingival fibroblast in early stages and thus may accentuate *P. gingivalis* LPS induced COX-2 synthesis. Furthermore, curcumin has inhibitory action on planktonic growth of several periodontal pathogens including *Aggregatibacter actinomycetemcomitans*, *F. nucleatum* and *P. gingivalis*.^[22]

The results of the present investigation shows that the test group using adjunctive oral curcumin gel showed better improvement in the reduction of plaque scores, gingival inflammation and gingival bleeding, as compared to the test group receiving only mechanical debridement as treatment modality. This finding is in accordance with the findings of studies conducted by Farjana *et al.*^[18] and Davi *et al.*^[23] Anitha *et al.*^[24] in a clinical trial of 30 patients compared 1% curcumin gel and 0.1% chlorhexidine gel following SRP and showed significant improvement in clinical parameters as also more reduction of colony forming units.

Chatterjee *et al.* used curcumin mouthrinse in comparison with Chlorhexidine mouthrinse and found significant reduction in plaque and GI. Similar results were obtained in the present study.^[25] Arunachalam *et al.* evaluated antiplaque effects of curcumin in gingivitis by evaluating salivary reactive oxygen species and proposed that antioxidant property of curcumin can be responsible toward its anti-inflammatory action.^[26] A pilot study on role of curcumin in gingivitis individuals concluded decrease in gingival inflammation post administration of curcumin.^[27]

A systematic review and meta-analysis on preclinical studies by Borgesa *et al.* suggested significantly reduces

alveolar bone loss in experimental models of periodontitis in rats.^[28]

Nagasri *et al.* evaluated effect of curcumin as adjunct to SRP and found significant reduction in microbial growth emphasizing antimicrobial property of Curcumin.^[29]

Ravishankar *et al.* performed local application of curcumin gel and found reduce gingival inflammation in periodontitis patients suggesting its anti-inflammatory action on periodontium.^[30]

The result of the present study shows that oral curcumin gel has significant anti-plaque, anti-inflammatory activity and the resolution of clinical signs of gingivitis was rapid in the group receiving oral curcumin gel along with SRP. A major limitation of the present study was the small sample size and short duration for determining the efficacy of experimental drug. Further longitudinal studies with large sample size are required for evaluating the efficacy of curcumin in the management of gingivitis.

Conclusion

Within the limitations of the present study, it can be concluded that curcumin gel can be effectively used as an adjunct to scaling and root planning and is more effective than scaling and root planning alone in the treatment of gingivitis. It has potent anti-inflammatory and anti-plaque action. The gel was biologically well tolerated and had good patient acceptance with no side effects or adverse drug reactions. Further research aimed at improving curcumin formulations and delivery systems may be beneficial in the treatment of periodontal disease. Large scale longitudinal randomized controlled trials are needed to prove the efficacy of curcumin.

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Nil.

Conflicts of interest

There are no conflicts of interest.

Ethical clearance

The study was approved by the Institutional Ethical Committee.

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