Evaluation of Antiinflammatory Effect of Curcumin Gel as an Adjunct to Scaling and Root planing in Chronic Periodontitis - A Clinical Study

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Abstract

Background: Periodontitis is a bacterial initiated chronic infection that leads to destruction of connective tissue supporting the teeth. Use of Herbal and Ayurvedic drugs has increased in recent times. Curcumin (diferuloylmethane), possess anti-oxidant, anti-inflammatory, anti-carcinogenic, anti-microbial, anti-hyperalgesic and hypocholesterolemic properties. The aim of this study is to evaluate the effect of Curcumin gel as an adjunct to scaling and root planing (SRP) in the management of chronic periodontitis.

Materials and Methods: 30 patients with chronic periodontitis were randomly divided into two groups. All patients underwent complete scaling and root planing. Experimental sites were treated with only SRP in Control group and SRP followed by intrapocket placement of Curcumin gel in Test group. Clinical parameters like Plaque Index, Gingival Index and Probing pocket depth were evaluated after 1 and 3 months interval from baseline in both groups.

Result: Patients in Test group shows significantly greater mean reduction in PI, GI and PPD compared to Control group.

Conclusion: Results encourage the use of Curcumin gel in the treatment of periodontitis.

Keywords: Curcumin gel, Chronic periodontitis, Local drug delivery.

Introduction

Periodontitis is inflammation and infection that destroys the tissues that support the teeth, including the gingiva, the periodontal ligament and alveolar bone. Bacterial plaque is the primary etiological agent in gingivitis. Mechanical plaque control, like scaling and root planing, is the first recommended step in the management of gingivitis and

periodontitis and is an indispensable phase of periodontal therapy. 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, discoloration of teeth and unpleasant taste can occur when these chemicals are used for an extended period of time. Herbal medicines have been used for thousands of years in developing countries and more than 80% of population relies on their use for health care needs. Turmeric, neem, aloevera, clove, cinnamon are among the common herbal products used in dentistry. Among this, turmeric has been used traditionally as a remedy for skin, stomach, liver ailments etc. Since turmeric has antimicrobial, antioxidant, astringent and other useful properties, it is useful in dentistry also.

Various local delivery devices have been used for the targeted delivery of antimicrobial agents, which includes fibers, strips and compacts, gels, micro particles, films and nano-particles. Natural ways to treat periodontal disease includes number of herbs that can help to eliminate inflammation and infection associated with periodontal diseases. Polyphenols are a group of phytochemicals that are rich sources for anti-oxidants. Among polyphenols, the most widely used substance is Turmeric, a rhizome of *Curcuma longa*, found to be distributed in tropical and subtropical regions of the world mainly as a spice. It is popularly called Haldi in India and named as a curry spice by British.

Curcuma longa is a member of Zingiberaceae family is indigenous to South East Asia and South America since about 2,500 years cultivated and used in India [1,2]. Turmeric (haldi), a rhizome of Curcuma longa, is a flavourful yellow-orange spice. It's a plant is three feet in height and has lance-shaped leaves and spikes of yellow flowers that grow in a fleshy rhizome or in underground stem. An orange pulp contained inside the rhizome constitutes the source of turmeric medicinal powder. Components of tumeric are named curcuminoids, which include mainly curcumin (diferuloyl methane), demethoxycurcumin, and bisdemethoxycurcumin. Curcumin (diferuloylmethane) is a polyphenol derived from Curcuma longa plant, commonly known as turmeric. The active constituents of turmeric are the flavonoid curcumin (diferuloylmethane) and various volatile oils including tumerone, atlantone, and zingiberone. Other constituents include sugars, proteins, and resins. The best-researched active constituent is curcumin.

Curcumin has been used for thousands of years as a dye, flavoring, and medicinal herb. It exhibits a big promise as a therapeutic agent. It also plays an important role in treating periodontal disease, to maintain good oral hygiene, oral cancers. It can also be used as a component in local drug delivery system in gel form[3]. Anti-inflammatory property of turmeric has been studied and has demonstrated significant reduction of inflammation[4]. In the present study, a polyherbal formulation (curcumin gel) as an adjunct to scaling and root planing was evaluated in the management of chronic periodontitis.

Materials and Method

This clinical study was carried out in the Department of Periodontics, Sidhpur Dental College and Hospital, Sidhpur. Total 30 patients of chronic periodontitis, without any history of periodontal or antibiotic therapy in past 6 months, aged 25 to 45 visiting the Out Patient Department of Periodontology of Sidhpur Dental College were selected. Ethical Committee provided the ethical clearance for the study. A split mouth design was planned so as to reduce the error variance of the experiment. Patients having minimum one tooth or site involving various quadrants of the mouth with probing depth

measuring 5 – 7 mm along with bleeding on probing were selected. The Exclusion criteria were: presence of any other known disease or condition or intake any medication that can affect the periodontal status, allergy to herbal medications, systemic antimicrobial therapy, aggressive periodontitis, smoking, alcoholism, immunocompromised state and pregnant or lactating females. After the study was explained, written informed consent was obtained from those who agreed to participate in the study.

The split mouth study was conducted for duration of 3 months. Selected sites were randomized into control and test sites by a coin toss. In test sites, Scaling and Root Planing was performed followed by locally delivered Curcumin gel (Cure next Oral Gel, Abbott Health Care, Mumbai, MH, India) and in control sites only Scaling and Root Planing was performed. Clinical parameters including Plaque Index (PI) (Silness and Loe), Gingival Index (GI) (Loe and Silness), and Probing pocket depth were recorded using UNC 15 probe with acrylic stent as a guide for reproducibility from the gingival margin to the base of the pocket and the value obtained was taken as baseline value (before SRP) and at 1 and 3 months later after LDD.

Local Drug Delivery

After thorough scaling and root planing, in test sites Curcumin gel was injected into the periodontal pockets using a disposable 2 ml syringe with a blunt canula. Periodontal dressing was placed after the placement of gel to prevent the turmeric gel from being expressed out of the gingival sulcus or the periodontal pocket. Oral hygiene instructions were given. Clinical parameters were recorded at baseline, 1 and 3 months interval.

Statistical Analysis

After completion of the data collection, statistical analysis was performed using parameter tests for the comparison between Test and Control groups. For each group, the mean values for PI [Table 1], GI [Table 2], and PPD [Table 3] were calculated at the baseline, 1 month and 3 months. Paired t-test was performed for difference within the group and ANOVA for difference between the groups.

Results

All 60 patients completed the study. No patients shown any adverse reaction or reported any discomfort. PI values at baseline for the Test and Control group were 2.71 ± 0.43 and 2.70 ± 0.41, respectively [Table 1]. There was not any significant difference between both the groups at the baseline (P = 0.64355). After 1 month, in the Test group there was significant improvement in PI values to 1.65 ± 0.40 (P < 0.001). After 3 month it was 1.22 ± 0.54. Similarly with the Control group, there was statistically significant difference from 2.70 ± 0.41 to 2.15 ± 0.81 in 1 month (P < 0.001). After 3 month it was 1.45 ± 0.67. On Intergroup comparison the difference was not significant (P = 0.4323).

At baseline, GI values [Table 2] for the Test group and Control group were: 2.90 ± 0.21 and 2.8 ± 0.56, respectively. There was not any significant difference between both the groups at the baseline (P = 0.415). After 1 month, in both the groups there was statistically significant improvement in GI values from 2.90 ± 0.21 to 1.80 ± 0.51 (P < 0.0001) and from 2.8 ± 0.56 to 2.26 ± 0.78 (P < 0.0001), respectively. After 3 month the GI value for Test and Control group was 1.56 ± 0.4 and 1.84 ± 0.56. In intergroup comparison showed that there was statistically significant improvement in GI in the Test group as compared to Control group (P< 0.0001).

At baseline, pocket depth values [Table 3] for the Test and Control group were 6.58 ± 1.21 and 6.12 ± 0.94, respectively. There was not any significant difference between both the groups at the baseline (P = 0.7548). After 1 month, in Test group there was a statistically significant decrease in pocket depth values from $6.58 \pm$

1.21 to 5.03 ± 0.25 and after 3 months, it was 3.23 ± 0.46 (P= 0.0008). In the Control group, there was also a significant decrease in the pocket depth values from 6.12 ± 0.94 to 6.00 ± 0.97 and at 3 month 4.08± 0.99 (P < 0.0001). The intergroup comparison showed statistically significant improvement in the Test group as compared to Control group.

Discussion

Periodontal disease is one of the most common periodontal infection affecting the mankind characterized by inflammatory lesions in the supporting periodontal tissues. Plaque is the main agent responsible for the breakdown of periodontal tissues leading to periodontal disease. Various pathogenic bacteria residing subgingival, play an important role in helping the disease to occur. The importance of subgingival microflora is widely recognized. However, its therapeutic approach by Scaling and root planing has proved to be of limited value in deep pockets and anatomical variations. The local or systemic use of antibacterial agents constitutes a promising therapeutic approach.

In recent times novel drugs are been tried in local drug delivery such as herbal products, growth factors and some drugs to rectify the osseous defects. Herbal drugs have long era of use and better patient tolerance as well as public acceptance. India has a rich history of using plants for medicinal purposes. Turmeric (*Curcuma longa* L.) is a medicinal plant extensively used in Ayurveda, Unani and Siddha medicine as home remedy for various diseases. Curcumin possess wound healing and anti-inflammatory property by virtue of which it reduces the inflammatory mediators generated via arachiodonic acid pathway and thereby reduced inflammatory edema and vascular engorgement of connective tissue[3].

This study was carried out to assess the efficacy Curcumin gel as an adjunct to scaling and root planing and their effect on periodontitis. In our study, highly significant reduction in the Probing depth scores, PI and GI was seen in Test group as compared to Control group from baseline to 90th day.

Behal *et al* [5] conducted a clinical trial in order to compare the effect of 2% whole turmeric gel along with scaling and root planning with the effect achieved using scaling and root planning alone. The effects on PI, GI, bleeding on probing pocket depth, relative attachment levels, trypsin-like enzyme activity of red complex microorganisms namely *Treponema denticola*, *Bacteroids forsythus* was assessed in a split-mouth study involving 30 subjects with chronic localized and generalized periodontitis. The results of the study concluded that 2% gel is more effective when used along with scaling and root planning than scaling and root planning alone in the treatment of periodontal pockets.

These results can be attributed to its anti-inflammatory property and wound healing property of Curcumin by virtue of which it reduces the inflammatory mediators generated via arachiodonic acid pathway and causes shrinkage by reducing inflammatory edema and vascular engorgement of connective tissue. It also promotes migration of various cells including fibroblasts in wound bed and thus results in reduction of vascularization by bringing about fibrosis of connective tissue. Curcumin promotes migration of epithelial cells to wounded sites by promoting localization of TGF-β1 thus helping re-epithelization [6].

Trend for reduction in pocket depth and gain in relative attachment levels by curcumin can be contributed to ability of curcumin in enhancing regeneration after traumatic injury as demonstrated by Sidhu et al in an *in vivo* experiment on rats and guinea pigs. It was found that curcumin treated wounds had increased TGF-β1 which enhances wound healing. Curcumin causes shrinkage of

tissues by reducing inflammatory edema and vascular engorgement of connective tissues [7].

A short term clinical trial has shown that curcumin irrigation was superior in restoring gingival health by reducing gingivitis using BOP and visual assessment of redness as indicators of gingival health [8].

Curcumin 1% as sub gingival irrigant resulted in significant reduction in bleeding on probing and redness, when compared with chlorhexidine and saline group as an adjunctive therapy in periodontitis patients[9]. Curcumin action in suppressing the activity of Toll like receptors (TLRs) and expanding its therapeutic potential in limiting or halting the destruction in periodontitis[10].

It is clear from the results of the present study that the experimental local drug along with scaling and root planing is effective in removing the local irritants, reducing gingival inflammation and reducing pocket depth. It also controls the localized infection and prevents new lesion formation.

The local drug-delivery system used in the present study is simple and easy to use. Its suitability for use with a syringe allows easy insertion into the pocket. Also, bioadhesive property of the experimental drug allows better retention. It is also biologically accepted without any side effects. -3

Curcumin exhibits its anti-inflammatory effect by increasing cortisone production by adrenal glands and by decreasing histamine levels and also by inhibiting the synthesis of prostaglandulins and neutrophil function. Hence in the present study, curcumin was found to be effective in removing local factors when performed along with scaling and root planning.

Thus, results of the present study brighten the futuristic aspect of using turmeric gel as a local drug delivery system in subgingival sites. The limitation of the present clinical trial was the small sample size and the short duration for determining the efficacy of the experimental drug. Thus, further longitudinal studies are recommended with larger sample size for the evaluation of the efficacy of this herbal agent in the treatment of chronic periodontitis. The concomitant biochemical and microbial analysis could also help in better interpretation of findings.

The experimental material was well accepted by the patient. Neither complications nor allergic reactions was found. The curcumin gel used in the present study is easy to use, which can be inserted into the pocket with the help of a syringe. Curcumin shows better retention within the pocket because of its bioadhesive property. Furthermore, curcumin gel was biologically acceptable to all patients without any complications or allergic reactions.

Conclusion

Curcumin is considered a safe, non-toxic and effective alternative for many traditional drugs because of its effects on various systems and therapeutic properties. Curcumin can be effectively used along with scaling and root planing. Curcumin is well accepted by the patient and is easy to use and requires less chair side time. Future research is required to determine the long-term effects of curcumin on a large sample of subjects.

With the interest in more natural drug substitutes for allopathic medicine in all fields of health care, the use of herbal drugs in periodontal disease is a huge step forward. The advantages of herbal drugs are that they are more easily available, they are cheaper and are known to have less adverse side effects because they are essential naturally available products.

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Legend Tables

Table 1: Plaque Index values at the baseline and after 1 and 3 months

Group	Baseline	1 month	3 months	*P* value	Intergroup *P* value
Test	2.71±0.43	1.65±0.40	1.22±0.54	<0.001 (S)	>0.001 (NS)
Control	2.70±0.41	2.15±0.81	1.45±0.67	<0.001 (S)	
Intergroup *P* value at baseline Intergroup *P* value at 1 month Intergroup *p* value at 3 month					0.6435 (NS) 0.1543 (NS) 0.4323 (NS)

Table 2: Gingival Index values at the baseline and after 1 and 3 months

Group	Baseline	1 month	3 months	*P* value	Intergroup *P* value
Test	2.90±0.21	1.80±0.51	1.56±0.4	<0.0001	<0.0001(HS)
Control	2.8±0.56	2.26±0.78	1.84±0.56	<0.0001	
Intergroup *P* value at baseline Intergroup *P* value at 1 month Intergroup *p* value at 3 month					0.415 (NS) <0.0001 (HS) <0.0001 (HS)

Table 3: Probing Depth values at the baseline and after 1 and 3 months

Group	Baseline	1 month	3 months	*P* value	Intergroup *P* value
Test	6.58±1.21	5.03±0.25	3.23±0.46	<0.0001	<0.0001(HS)
Control	6.12±0.94	6.00±0.97	4.08±0.99	<0.0001 (0.0008)	
Intergroup *P* value at baseline Intergroup *P* value at 1 month Intergroup *p* value at 3 month					0.7548 (NS) <0.0001 (HS) <0.0001 (HS)