

Comparative evaluation of the efficacy of locally delivered 0.1% curcumin irrigation, meswak irrigation and 0.2% CHX irrigation in management Chronic periodontitis patients

Rajat Singhla^{1,*}, Siddharth Tevatia², Shubhi Chaudhry³, Shubhra Vaish⁴, Vidya Dodwad⁵

^{1,2}PG Student, ³MDS, ⁴Professor, ⁵Professor & HOD, Dept. of Periodontology & Oral Implantology, I.T.S Centre for Dental Studies & Research, Muradnagar, Ghaziabad, Uttar Pradesh, India

***Corresponding Author:**

Email: drrs82@gmail.com

Abstract

Introduction: Ayurvedic medicines like turmeric possess anti-inflammatory, anti-oxidant, and anti-microbial properties. This study was carried out using the purest form of turmeric and meswak to test their anti-plaque and anti-inflammatory properties in the form of a sub gingival irrigation. The aim of the present study was to evaluate the clinical efficacy of locally delivered curcumin irrigation and meswak irrigation as an adjunct to scaling and root planing in the treatment of chronic periodontitis.

Materials and Method: Study group consisted of patients diagnosed with chronic periodontitis, aged between 21-45 years. 30 sites with pocket depth >5mm were selected and randomly divided into 3 groups. Group A: Test group received 0.1% curcumin (CU) irrigation along with scaling and root planing. Group B: Test group received meswak (HIORA) irrigation along with scaling and root planing. Group C: Control group received scaling and root planing along with 0.2% chlorhexidine(CHX) irrigation as positive control. Clinical parameters: Plaque index, bleeding index, probing pocket depth and relative attachment level were measured for each patient at baseline and 21 days. Plaque samples were taken at baseline and 21 days interval and total colony count was done.

Results: All the groups showed significant improvement in all clinical parameters from baseline to 21 days. There was statistically significant improvement in gingival index in Group A as compared to other groups. However, intergroup differences in other clinical parameters were not significant. The percentage reduction in microbial load at the 21 days was highest in chlorhexidine group.

Keywords: Curcumin, Meswak, Chronic periodontitis, Chlorhexidine, Relative attachment level

Introduction

Periodontitis is a chronic inflammatory disease of tooth supporting structures causing gradual tooth loss. As the major etiology behind development of periodontitis is dental plaque, much of the research should be directed towards a more effective and economic way of controlling dental plaque and further disease progression.⁽¹⁾

The mechanical plaque control involves tooth brushing either using a manual brush, powered tooth brush or using pressurized water pump system which involves the use of water under pressure which is pumped through fine blunt needle or nozzle.⁽²⁾ As the probing depth increases, the efficacy of the mechanical aids in controlling the pathogenic flora and their toxic products decreases. Hence efforts are made to develop a therapeutic system that use the subgingival delivery of antimicrobial agents.⁽³⁾ From the past four decades, one of the effective means for the treatment of periodontal diseases is subgingival irrigation. Delivery of antimicrobial agents subgingivally is one of the potent means of oral hygiene regime in both home and office procedures. Various antimicrobial agents such as CHX,⁽⁴⁾ metronidazole,⁽⁵⁾ tetracycline⁽⁶⁾ and herbal products⁽⁷⁾ have been proven to be efficacious in management of periodontal disease.

The substantivity and antiplaque property of Chlorhexidine Gluconate (CHX) has proven to be the

gold standard.⁽⁸⁾ CHX which is a cationic broad-spectrum antimicrobial agent, acts mainly by preventing pellicle formation and causes disruption of the outer bacterial membrane preventing cell wall adsorption and binding of mature plaque. Till date, chlorhexidine is considered as the best anti plaque agent and it has been shown that the use of 0.2% CHX prevents development of experimental gingivitis.⁽⁹⁾

Though the use of such synthetic compounds offers certain disadvantages like staining of teeth, alteration of taste sensation etc., this led to the need of developing certain herbal products which are safe. Various herbal extracts such as, *Aloe Vera*, *Ocimum Sanctum*, *Matricaria Chamomile*, etc. have been shown to have potent anti-inflammatory, anti-oxidant and antibacterial properties and thus proving to be effective in improving gingival health.⁽¹⁰⁾

One such herbal extract is Curcumin (CU) which is a yellow coloured pigment obtained from *Curcuma longa*. *Curcuma longa* comprises three major curcuminoids (approximately 77% Curcumin, 17% dimethoxy curcumin and 3% bisdemethoxy curcumin).⁽¹¹⁾ The antioxidant,⁽¹²⁾ antibacterial,⁽¹³⁾ anti-inflammatory⁽¹⁴⁾ and chemotherapeutic⁽¹⁵⁾ properties of Curcumin makes it an effective agent to be used as a subgingival irrigant. The inhibition of pro-inflammatory leukotriens, prostaglandins and neutrophil function attributes to its anti-inflammatory property.⁽¹⁴⁾ However

due to limited literature regarding the efficacy of oral irrigants on the clinical and microbiological parameters, this study aimed to compare and evaluate the efficacy of locally delivered 0.1% curcumin irrigation and meswak irrigation in management of chronic periodontitis patients.

Materials and Method

Patients diagnosed with chronic periodontitis, aged between 21-45 years were selected from the Outpatient Department of Periodontology and Oral Implantology, I.T.S Centre for Dental Studies & Research, Muradnagar, Ghaziabad, U.P. Ethical clearance was obtained from Institutional review board and informed consent was taken from the patients.

30 sites with pocket depth >5mm were selected and randomly divided into 3 groups. Group A received 0.1% curcumin irrigation along with scaling and root planing. Group B received meswak (HIORA) irrigation along with scaling and root planing and Group C received scaling and root planing along with 0.2% chlorhexidine irrigation as positive control.

Upper and lower impressions were made and acrylic stents were prepared. A vertical groove was cut in the stent so that the point of entry of the probe could be standardized at each visit. During the first visit (day 0) after obtaining informed consent, all the clinical

parameters including plaque index (Silness and Loe),⁽¹⁶⁾ Gingival index (Loe and Silness),⁽¹⁷⁾ Probing Pocket Depth (PPD) and Relative Attachment Level (RAL) were measured. UNC-15 graduated periodontal probe was used to measure the clinical parameters.

Patients with probing depth of ≥ 5 mm or relative attachment level (RAL) $\geq 4-6$ mm and vertical bone loss ≥ 3 mm on intraoral periapical radiographs were included in the study.

Patients who were medically compromised, with any history of allergy to the material used, on antibiotics or antimicrobial therapy in previous 6 months or on any drug therapy which is known to influence the periodontium were not included in the study. Patients who were pregnant or lactating and who were tobacco users were also excluded from the study.

After thorough scaling and root planing, each site was irrigated with the respective irrigant (2ml) twice at an interval of 1 minute at baseline. For irrigating the sites, 2 ml syringe with a 24 gauze needle was used. Patients were made aware about the importance of maintaining oral hygiene. Same procedure was repeated after 7 and 21 days. Subgingival plaque samples were collected with the help of a curette and inoculated on blood agar followed by incubation for 24 hrs. Aerobic colony count was performed at baseline and 21 days.

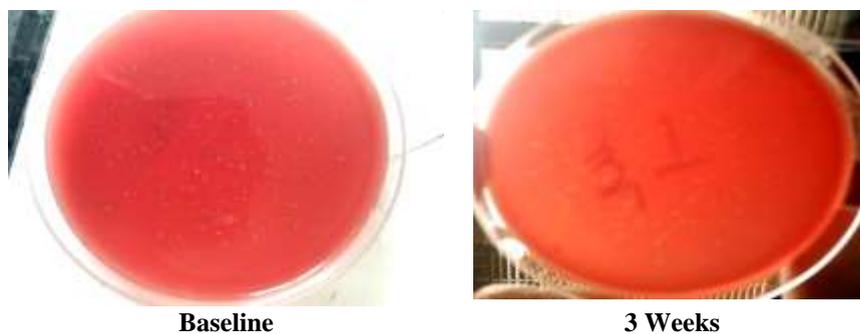


Fig. 1: Comparison of colony forming units at baseline and 3 weeks in Group A

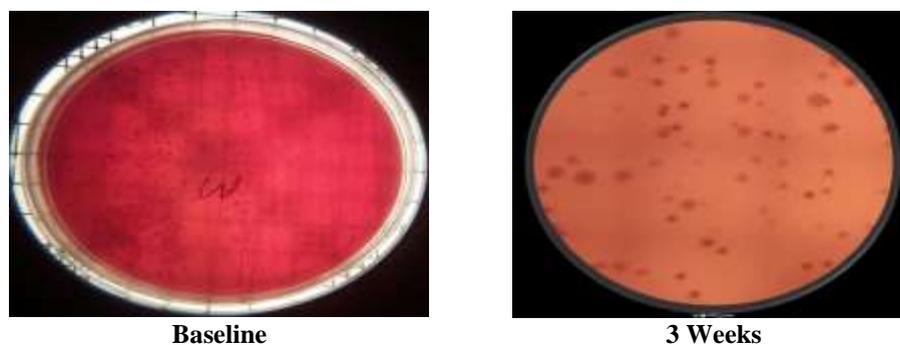


Fig. 2: Comparison of colony forming units at baseline and 3 weeks in Group B

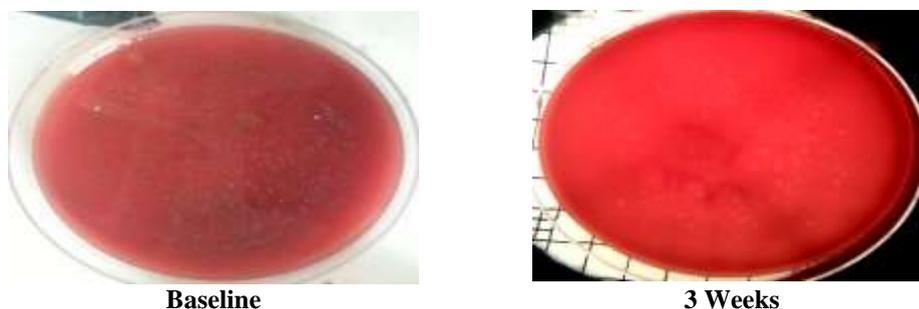


Fig. 3: Comparison of colony forming unit at baseline & 3 weeks in Group C

Statistical Analysis: Statistical analysis was carried out using Statistical Package for Social Sciences (SPSS Inc., Chicago, IL, version 16.0 for windows). Test for qualitative variables, mean and standard deviation were calculated. Gingival index, Plaque index, Probing Pocket Depth and RAL were compared statistically between the groups using one way ANOVA and Kruskal Wallis test.

Results

After thorough sub-gingival irrigation at different time intervals including the baseline, results were evaluated at 21 days. In the present study, the mean gingival index reduced significantly in all three groups at 21 days (Table 1). Also on intergroup comparison significant reduction was observed at 21 days. The plaque index, probing depth and RAL (Table 1) decreased drastically in all the groups but on intergroup comparison no significant differences were observed at 21 days. There was no significant difference between any of the groups but the groups (CHX, CU and MESWAK) produced reduction in all the clinical parameters.

Microbial Count

There was a significant reduction in microbial colony count when all three groups were evaluated at 21 days (Table 2, Fig. 1-3). Maximum reduction in colony forming units was observed in Group C followed by Group A.

Table 1: Intergroup comparison of various clinical parameters

Clinical Parameters		CHX	Curcumin	MESWAK	p Value
Plaque Index (PI)	Baseline	3.63±.518	4.75±.463	3.0±.756	.549
	21 Days	1.13±.354	1.25±.463	1.38±.518	
Gingival Index (GI)	Baseline	1.63±.518	1.63±.518	1.50±.535	0.025*
	21 Days	.38±.518	.68±.518	.04±.000	
Probing Pocket Depth(PPD)	Baseline	7.50±.926	7.25±1.282	7.0±1.69	.282
	21 Days	5.50±1.06	5.25±1.28	4.63±.916	
RCAL	Baseline	9.75±.463	10.25±1.188	10.25±1.18	.850
	21 Days	7.38±.916	7.25±1.282	7.00±1.69	

Table 2: Reduction in microbiological load and percentage reduction at 21 Days in all the 3 Groups

Group	Baseline	21 Days	% Reduction
CHX	259.6	79.6	69.10
CURCUMIN	276.4	115.6	58.17
MESWAK	267	124.4	53.40

Discussion

Curcumin has been widely studied throughout literature for its anti-inflammatory, anti-oxidant, antibacterial and wound healing properties. However; its application in dentistry has been reported only in the last decade. Therefore this clinical study was carried out to assess the clinical and anti-microbial efficacy of curcumin irrigation as an adjunct to scaling and root

planing as compared to Herbal and CHX irrigation. The results of this study showed that all the parameters decreased significantly in all the three groups, though CHX proved to be highly efficacious in reducing the microbial load (69.10% reduction) as compared to CU and meswak. There were no significant difference between CHX and CU ($p < 0.05$) in terms of plaque index. These results are in accordance with the study done by Vinholis et al⁽¹⁸⁾ and Paolantonio et al⁽¹⁹⁾ who showed no significant differences in plaque index between CHX and CU. In the present study the reduction in probing pocket depth in between CHX and CU groups at the end of 21 days were non-significant, these results are in accordance with the study done by Nayyar et al,⁽²⁰⁾ Mizrak et al.⁽²¹⁾ In contrast to this study, Gottumukkala et al⁽²²⁾ showed an increase in the

pocket depth scores in CU group from 1 months to 6 months interval which might be due to its reduced substantivity on the root surface over a period of time. The result of the microbiological study showed that chlorhexidine was much more efficacious in reducing the microbial load as compared to CU and meswak. In another study, Gottumukkala et al⁽¹⁾ observed that CU group showed better reduction in microbial load as compared to chlorhexidine, though the difference was non-significant. These results can be attributed to the anti-inflammatory and antioxidant properties of CU.

Significantly higher improvement in gingival inflammation in Curcumin group can be attributed to the down regulation of inflammatory response by curcumin. Curcumin reduces the activity of cyclooxygenase-2 (COX-2), lipoxygenase, and inhibits the production of the inflammatory cytokines like tumor necrosis factor- alpha (TNF- α), interleukin (IL) - 1, -2, -6, -8, and -12 and monocyte chemoattractant protein (MCP).⁽²³⁾

The efficacy of CHX can be attributed to its substantivity and its slow release in the oral cavity. However the results of chlorhexidine were far more superior than herbal products, though the latter didn't include any other side effects. Almas et al⁽²⁴⁾ conducted a study to determine the efficacy of eight mouthwashes and concluded that the mouthwash containing chlorhexidine was much more efficacious.

Conclusion

Within the limitations of this study, chlorhexidine gluconate, curcumin and meswak proved to be equally efficacious in showing anti-plaque activity. Curcumin irrigation was more effective in reducing the gingival inflammation in patients with chronic periodontitis. Hence it was concluded that though CHX and herbal agents showed similar efficacy in terms of pocket depth reduction, in consideration of reduced side effects and better patient compliance, the latter can be used as an alternative. Future directions of this study should target on improving the substantivity of the drugs and on using the varied concentrations of the drugs so that maximum therapeutic benefit can be obtained in the management of periodontal disease.

References

- Gottumukkala SN, Koneru S, Mannem S, Mandalapu N. Effectiveness of sub gingival irrigation of an indigenous 1% curcumin solution on clinical and microbiological parameters in chronic periodontitis patients: A pilot randomized clinical trial. *Contemp Clin Dent* 2013;4(2):186-191.
- Haffajee AD, Smith C, Torresyap G, Thompson M, Guerrero D, Socransky SS. Efficacy of manual and powered toothbrushes (II). Effect on microbiological parameters. *J Clin Periodontol* 2001;28(10):947-54.
- Brayer WK, Mellonig JT, Dunlap RM, Marinale KW, Carson RE. Scaling and root planing effectiveness: The effect of surface access and operator experience. *J Periodontol* 1989; 60:67-72.
- Walsh TF, Glenwright HD, Hull PS. Clinical effects of pulsed oral irrigation with 0.2% chlorhexidine digluconate in patients with adult periodontitis. *J Clin Periodontol* 1992;19:245-8.
- Linden GJ, Newman HN. The effects of sub gingival irrigation with low dosage metronidazole on periodontal inflammation. *J Clin Periodontol* 1991;18:177-81.
- Fernandes LA, Martins TM, Almeida JM, Nagata MJ, Theodoro LH, Garcia VG, et al. Experimental periodontal disease treatment by sub gingival irrigation with tetracycline hydrochloride in rats. *J Appl Oral Sci* 2010;18:635-40.
- Gebaraa EC, Pustigliani AN, de Lima LA, Mayer MP. Propolis extract as an adjuvant to periodontal treatment. *Oral Health Prev Dent* 2003;1:29-35.
- Flötra L, Gjerme P, Rölla G, Waerhaug J. Side effects of chlorhexidine mouth washes. *Scand J Dent Res* 1971;79(2):119-25.
- Jones CG. Chlorhexidine: Is it still the gold standard? *Periodontol* 2000 1997;15:55-62.
- Aggarwal BB, Sundaram C, Malani N, Ichikawa H. Curcumin: the Indian solid gold. *Adv Exp Med Biol* 2007;595:1-75.
- Chattopadhyay I, Biswas K, Bandyopadhyay U, Banerjee RK. Turmeric and curcumin: Biological actions and medicinal applications. *Curr Sci* 2004;87:44-50.
- Sharma OP. Antioxidant activity of curcumin and related compounds. *Biochem Pharmacol* 1976;25:1811-2.
- Negi PS, Jayaprakasha GK, Mohan Rao Jagan L, Sakariah KK. Antibacterial activity of turmeric oil: A byproduct from curcumin manufacture. *J Agric Food Chem* 1999;47:4297-300.
- Menon VP, Sudheer AR. Antioxidant and anti-inflammatory properties of curcumin. *Adv Exp Med Biol* 2007;595:105-25.
- Campbell FC, Collett GP. Chemopreventive properties of curcumin. *Future Oncol* 2005;1:405-14.
- Silness J, Loe H. Periodontal Disease in Pregnancy. II. Correlation Between Oral Hygiene and Periodontal Condition. *Acta Odontol Scand* 1964;22:121-35.
- Loe H, Silness J. Periodontal Disease in Pregnancy I. Prevalence and Severity. *Acta Odontol Scand* 1963;21:533-51.
- Vinholis AH, Figueiredo LC, Marcantonio JE, Marcantonio RA, Salvador SL, Goissis G. Subgingival utilization of 1% chlorhexidine collagen gel for the treatment of periodontal pockets. A clinical and microbiological study. *Braz Dent J* 2001;12:209-13.
- Paolantonio M, Ercole S, Piloni A, D' Archivo D, Lisanti L. Clinical, microbiological and biochemical effects of subgingival administration of xanthan based chlorhexidine gel in the treatment of periodontitis. A randomized multicenter trial. *J Periodontol* 2009;80:1479-82.
- Nayyar N, Dodwad V, Arora K. Comparative evaluation of 1% curcumin solution and 0.2% chlorhexidine irrigation as an adjunct to scaling and root planing in management of chronic periodontitis: A clinic-microbiological study. *J Pharma Biomed Sci* 2012;14:1-7.
- Mizrak T, Guncu GN, Caglayan F, Balci TA, Akhtar GS, Ipek F. Effect of controlled release chlorhexidine chip on clinical and microbiological parameters and prostaglandins E2 levels in gingival crevicular fluid. *J Periodontol* 2006;77:437-43.
- Gottumukkala SN, Sudarshan S, Mantena SR. Comparative evaluation of the efficacy of 2 controlled release devices: Chlorhexidine chips and indigenous

- curcumin based collagen as local drug delivery systems. *Contemp Clin Dent* 2014;5(2):175-81.
23. Jurenka JS. Anti-inflammatory Properties of Curcumin, a Major Constituent of *Curcuma longa*: A Review of Preclinical and Clinical Research. *Alt Med Rev* 2009;14(2):141- 53.
 24. Almas K, Skaug N, Ahmad I. An in vitro antimicrobial comparison of miswak extract with commercially available non-alcohol mouthrinses. *Int J Dent Hyg* 2005;3:18-24.