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Research Article

COMPARATIVE EVALUATION OF EFFICACY OF CURCUMA LONGA GEL AND CHLORHEXIDINE GEL AS AN ADJUNCT TO SRP AND SRP ALONE IN PATIENTS SUFFERING FROM CHRONIC PERIODONTITIS

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A R T I C L E I N F O

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Chlorhexidine, chronic periodontitis, turmeric gel, inflammation.

A B S T R A C T

Background: This study aims to evaluate and compare the clinical effects of a topical subgingival application of a curcuma longa gel and chlorhexidine gluconate gel as an adjunct to SRP and SRP alone in patients suffering from chronic periodontitis.
Methods: Ninety patients with generalised periodontitis with a pocket depth of 5-7mm were selected. On completion of SRP, each patients were divided into three different groups, that is, **Group 1:** those receiving turmeric gel, **Group 2**: those receiving 1% chlorhexidine gel, **Group 3:** those receiving SRP alone (Control Site). Plaque index, gingival index, probing depth and clinical attachment level were taken at 1month and 3rd month.
Result: Group 2 as a local drug system was better than group 3 and group 1. Group 1 also showed comparable improvement in all the clinical parameters as group 2.
Conclusion: The experimental local drug delivery system turmeric gel helped in reduction of probing depth and gain in clinical attachment levels.

INTRODUCTION

Periodontitis is an inflammatory disease of the supporting tissues of the teeth caused by specific microorganisms or groups of specific microorganisms, resulting in progressive destruction of the periodontal ligament and alveolar bone with pocket formation, recession, or both.[1] Periodontitis is one of the most prevalent chronic diseases in the world, with the primary etiological agent being pathogenic bacteria that reside in the subgingival area.[2] The major approach in the prevention and treatment of periodontitis is the removal of supra and subgingival plaque. As this conventional therapy is not always successful, various antibiotics and antimicrobial agents have been suggested as adjuncts to enhance the efficacy of mechanical plaque control.[3] Classically, three methods of drug delivery have been used for periodontal disease therapy: systemic administration of antibiotics, topical administration of antibacterial agents and subgingival application of both.[3] However, comprehensive mechanical debridement of sites with deep periodontal pockets is difficult to accomplish. It alone may fail to eliminate the pathogenic microflora because of their location within the gingival and dental tissues or in other areas inaccessible to periodontal instruments. As an adjunctive approach, systemic or local administration of antibiotics is done because of the microbial etiology of periodontitis.[4] Various disadvantages of the systemic antibiotic therapy, like hypersensitivity reaction, organ toxicity and development of resistant bacteria coupled with its requirement of higher doses to attain required GCF concentration at the target site, led to the use of local drug-delivery system.[5] Local drug delivery systems allow the therapeutic agents to be targeted to the disease site. For local drug delivery, various agents have been used including tetracycline, chlorhexidine, metronidazole either alone or in combination with scaling. Thus, the dose can be minimized, reducing the systemic absorption and subsequent risk of adverse side effects.[5] The quest for the ideal medicament for local drug delivery is an ongoing process. One amongst them is Turmeric (*Haldi*), a rhizome of Curcuma longa, a common antiseptic used in traditional system of Indian medicine. Curcumin (diferuloylmethane), the main yellow bioactive component of turmeric, has been shown to have a wide spectrum of biological actions. It exerts its anti-inflammatory action by

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inhibiting the gene and protein expressions of inflammatory cytokines TNF-α and IL-1β.[7] It also shows favourable reduction of trypsin like enzyme activity of microorganisms associated with periodontal disease.[5] Curcumin induces apoptotic cell death by DNA damage in human cancer cell, so it also has a strong anticarcinogenic effect.[6] It is also a non-toxic, highly promising natural antioxidant compound having a wide spectrum of biological actions.[6] According to a study by Roobal Behal and co-workers in 2011, 2% whole turmeric gel can be effectively used as an adjunct to scaling and root planing and is more effective than scaling and root planing (SRP) alone in the treatment of periodontal pockets. Another local drug used subgingivally is chlorhexidine, it has long been the gold standard for subgingival chemical plaque control regimens. Its efficacy as a topical rinse to inhibit dental plaque and gingivitis has been well established without evidence of development of any bacterial resistance.[7] It has been found to be effective against sub gingival bacteria when delivered through a sustained release device. Chlorhexidine has been shown to be an effective agent in plaque inhibition as it is well retained (substantivity) in the oral cavity. It is safe and is acceptable in terms of cost and ease of use.[8] Locally delivered chlorhexidine can be used subgingivally in the forms of gel and chip. The present study is aimed at comparative evaluation of the efficacy of curcuma longa gel and chlorhexidine gluconate gel as an adjunct to SRP and SRP alone in patients suffering from chronic periodontitis. Curcuma longa is used for the study because recent evidence support the use of curcuma longa as a local drug, but its role has not been completely established. So, more research is needed to establish the efficacy of curcuma longa. Moreover, it is also cost effective and easily available. Hence if the effectiveness of curcuma longa is established, it can provide more choices to the clinician. In this study Curcuma longa is compared with chlorhexidine because chlorhexidine is already an established local drug.

MATERIAL AND METHODS

A study was undertaken for comparative evaluation of efficacy of curcuma longa gel and chlorhexidine gluconate gel as an adjunct to SRP and SRP alone in patients suffering from chronic periodontitis. The study was in compliance with the ethical principles for medical research and was approved by the ethical committee of Buddha Institute of Dental Sciences and Hospital, Patna, Bihar. Ninety sites from different Patients (males and females, aged 20-50 years) suffering from generalized chronic periodontitis were selected amongst the patients visiting the Department of Periodontology, BIDSH, Patna.

Subject Selection

Inclusion criteria

- Patients with probing pocket depth of≥5mm in atleast two non- adjacent sites in different quadrants of the mouth.
- Systemically healthy patients
- Patients with equal to or more than 20 teeth
- Co-operative patients who could be motivated for further oral hygiene instructions
- Patients who have consented to participate in the study

Exclusion Criteria

- Patients on antibiotic therapy within 1 month
- Pregnant or lactating women
- Subjects who use tobacco in any form
- Patients reporting known allergies to turmeric or chlorhexidine

Clinical parameters used for assessment

- Plaque score using Plaque Index (PI; Silness and Löe1964)
- Gingivitis using Gingival Index (GI; Löe and Silness1963)
- Probing depth: Measured by UNC-15 probe standardized by stent
- Clinical attachment level: Determined by measuring the distance between base of the pocket and the cemento-enamel junction

Material

1. Curcuma longa gel *(Curenext®, Abbott)*
2. 1% Chlorhexidine gel *(Hexigel®, ICPA)*
3. Syringe 3 ml *(Safe Plus®)*
4. Periodontal pack *(GC COE –PAK®)*(Fig- 1)

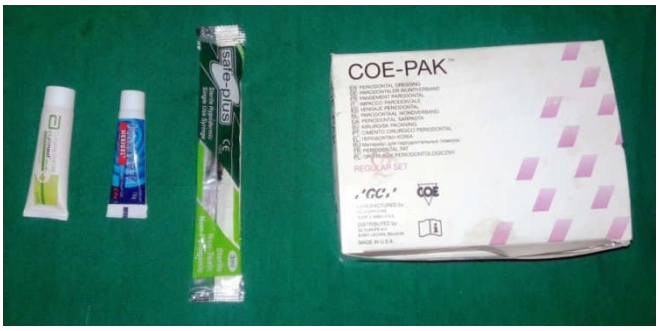
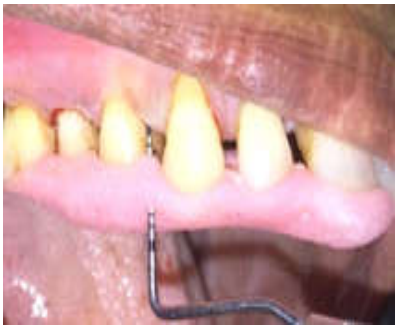


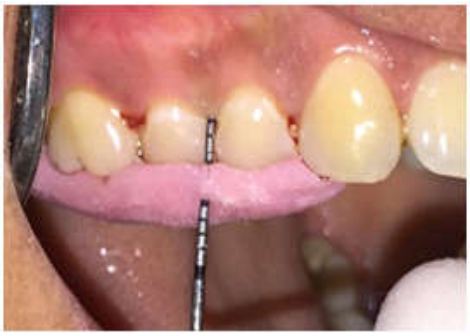
Fig 1 Materials used in local drug delivery

METHODS

The procedure was explained to the patient & written consent of the patient was taken A detailed medical and dental case history was recorded for the selected patients. All the clinical parameters were recorded at the baseline which was followed by SRP. Site specific customized cold cure acrylic stent was made for each selected site of each patient. All the stents were preserved for future reference. In each patient, on the completion of SRP, selected sites with probing depths ≥5mm were randomly divided into one experimental group (either Group I or Group II) and one control group (Group III) in different quadrants. (Fig- 2a, 2b)



a) Pocket depth at baseline for (Group 1)

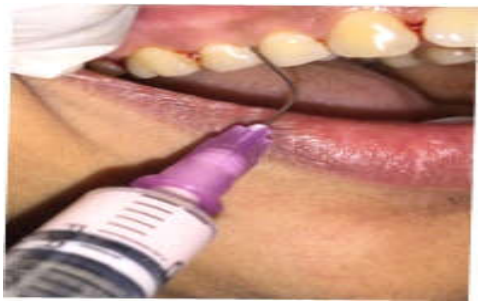


b) Pocket depth at baseline (Group 2)

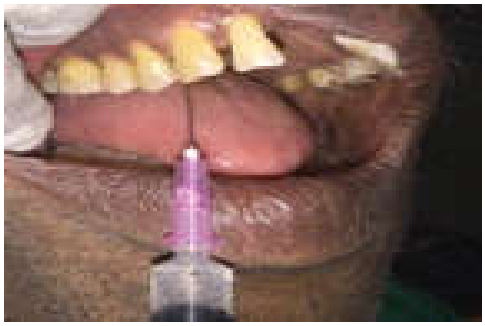
Fig 2

Material Used

- Group I: Those receiving turmeric gel (Curenext®)(Fig- 3a)
- Group II: Those receiving 1% chlorhexidine gel (Hexigel®) (Fig- 3b)
- Group III: SRP alone (control site)



a) Curenext delivered (Group 1)

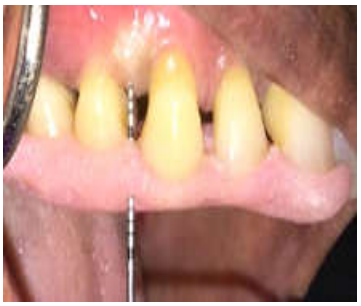


b) Hexigel delivered (Group 2)

Fig 3

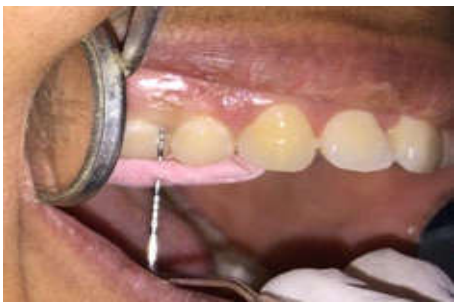
A patch test was conducted on each patient for ascertaining whether the patient was allergic to curcuma longa / chlorhexidine. Both the turmeric gel and chlorhexidine gel were delivered into the selected sites in Group I and Group II, respectively, using a syringe with a needle attached to it. Then these sites were covered with periodontal pack (COE PAK®).The patients were instructed to continue with the regular oral hygiene measures. All the subjects were recalled after 7 days for pack removal and evaluation for any clinical sign of inflammatory response. They were then recalled after 1 month (Fig-4a,4b) and 3 month of placement of the local drug to record the clinical parameters**.** (Fig-5a,5b) All the recorded parameters were sent to statistical analysis to draw conclusion.

a) Pocket depth at 1 month (Group 1)

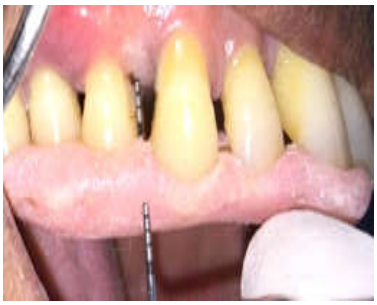


b) Pocket depth at 3months (Group 1)

Fig 4



a) Pocket depth at 1 month (Group 2)



b) Pocket depth at 3rd months (Group 2)

Fig 5

Statistical tests used

The following methods of statistical analysis have been used in the study. Data was entered in Microsoft excel and analysed using GraphPad (version 6). 'p' value of less than 0.05 was accepted as indicating significance. Wilcoxon matched-pairs signed rank test**:** The Wilcoxon signed-rank test is a non-parametric statistical hypothesis test used when comparing two related samples, matched samples, or repeated measurements on a single sample to assess whether their population mean ranks differ (i.e. it is a paired difference test). Mann Whitney test: Mann-Whitney U test is the alternative test to the independent sample t-test. It is a non-parametric test that is used to compare two population means that come from the same population, it is also used to test whether two population means are equal or not.

RESULTS

The following results were obtained.

Plaque Index

The mean PI score at baseline, 1 month and 3 months were observed to be 1.18±0.38, 0.78±0.48, 0.93±0.69, respectively for Group I. It was found to be 1.14±0.35, 0.69±0.52, 0.66±0.66, respectively for Group II. For Group III it was 1.26±0.44, 0.95±0.31, 1.19±0.55, respectively. (Table-1)

Table 1 Comparative analysis of clinical parameters at different time intervals

Clinical parameters	Groups	Observaton Period	Mean±SD	P value
Plaque Index	Group I	Baseline	1.18±0.38	
		1st month	0.78±0.48	0.008 (S)
		3rd month	0.93±0.69	0.051
	Group II	Baseline	1.14±0.35	
		1st month	0.69±0.52	0.0002(S)
		3rd month	0.66±0.66	0.001(S)
	Group III	Baseline	1.26±0.44	
		1st month	0.95±0.31	0.0009(S)
		3rd month	1.19±0.55	0.5059
Gingival Index	Group I	Baseline	2.0±0.0	
		1st month	1.05±0.9	0.001(S)
		3rd month	1.08±0.94	0.001(S)
	Group II	Baseline	1.76±0.43	
		1st month	0.81±0.86	0.001(S)
		3rd month	1.0±0.96	0.001(S)
	Group III	Baseline	1.74±0.44	
		1st month	1.23±0.9	0.0006(S)
		3rd month	1.09±0.92	0.001(S)
Pocket probing depth	Group I	Baseline	5.08±0.27	
		1st month	2.6±1.26	0.001(S)
		3rd month	2.48±1.43	0.001(S)
	Group II	Baseline	5.14±0.47	
		1st month	2.41±0.8	0.001(S)
		3rd month	2.17±1.01	0.001(S)
	Group III	Baseline	5.16±0.48	
		1st month	2.56±1.03	0.001(S)
		3rd month	2.44±0.96	0.001(S)
Clinical attachment level	Group I	Baseline	5.18±0.55	
		1st month	2.78±1.46	0.001(S)
		3rd month	2.62±1.43	0.001(S)
	Group II	Baseline	5.48±1.15	
		1st month	2.74±1.23	0.001(S)
		3rd month	2.55±1.42	0.001(S)
	Group III	Baseline	5.37±0.93	
		1st month	2.79±1.32	0.001(S)
		3rd month	2.57±1.17	0.001(S)

Intragroup comparison (Table-1)

Group I and Group III

The mean PI score at1 month was found to be statistically significant as compared to baseline. The mean PI score at 3 month was non-significant as compared to baseline.

Group II

A statistically significant difference was observed in the mean PI score at 1 month (p=0.0002) compared to baseline. The mean value of PI at 3 months was statistically significant (p=0.001) from baseline.

Intergroup comparison (Table-2)

The mean difference in PI score was non-significant at baseline (p=0.6976), 1 month (0.4329) and 3 months (0.0816) for Group I and Group II. However for Group I and Group III, PI score was significantly different at 1 month (p= 0.0414) compared to baseline (p= 0.378) and 3 months (p= 0.0674). For Group II and Group III, PI value was statistically significant at 1 month (p= 0.0049) and 3 months (p=0.0002) as compared to baseline (p= 0.1979).

Table 2 Intergroup analysis of clinical parameters at different time intervals

Clinical parameters	Observaton Period	Groups		P value
Plaque Index	Baseline	Group I	Group II	0.6976
		Group I	Group III	0.378
		Group II	Group III	0.1979
	1st month	Group I	Group II	0.4329
		Group I	Group III	0.0414(S)
		Group II	Group III	0.0049(S)
	3rd month	Group I	Group II	0.0816
		Group I	Group III	0.0674
		Group II	Group III	0.0002(S)
Gingival Index	Baseline	Group I	Group II	0.0011(S)
		Group I	Group III	0.0007(S)
		Group II	Group III	0.8553
	1st month	Group I	Group II	0.2262
		Group I	Group III	0.3485
		Group II	Group III	0.03(S)
	3rd month	Group I	Group II	0.7278
		Group I	Group III	0.944
		Group II	Group III	0.661
Pocket probing depth	Baseline	Group I	Group II	0.6838
		Group I	Group III	0.4985
		Group II	Group III	0.8025
	1st month	Group I	Group II	0.8897
		Group I	Group III	0.9263
		Group II	Group III	0.781
	3rd month	Group I	Group II	0.5004
		Group I	Group III	0.497
		Group II	Group III	0.1184
Clinical attachment level	Baseline	Group I	Group II	0.4687
		Group I	Group III	0.4028
		Group II	Group III	0.9525
	1st month	Group I	Group II	0.7471
		Group I	Group III	0.6914
		Group II	Group III	0.8895
	3rd month	Group I	Group II	0.7697
		Group I	Group III	0.8016
		Group II	Group III	0.537

Gingival Index

The mean GI scores at baseline, 1 month and 3 months were observed to be 2.0±0.0, 1.05±0.9, 1.08±0.94 respectively for Group I. It was found to be 1.76±0.43, 0.81±0.86, 1.0±0.96, respectively, for Group II. For Group III it was 1.74±0.44, 1.23±0.9 and 1.09±0.92, respectively. *(Table-1)*

Intragroup comparison (Table-1)

Group I, Group II and Group III

The mean difference in GI score at 1 month was found to be statistically significant as compared to baseline. The mean difference in GI score at 3 month was found to be statistically significant (p=0.001) as compared to baseline.

Intergroup comparison (Table-2)

The mean GI score at 3 month was found to be statistically significant (p=0.001) as compared to baseline. Mean difference in GI score between Group I and Group II was statistically significant at baseline (p= 0.0011), but non-significant at 1 month (p=0.2262) and 3 months (p= 0.7278). However, mean difference in GI score between Group I and Group III was statistically significant at baseline (P=0.0007), and non-significant at 1 month (p= 0.3485) and 3 months (p= 0.944). For Group II and Group III, mean values was statistically significant at 1 month (p= 0.03) as compared to

baseline (p= 0.8553) but non-significant (p= 0.661) at the end of 3rd months.

Probing Pocket Depth

The mean probing depths at baseline, 1 month and 3 months were 5.08±0.27, 2.6±1.26 and 2.48±1.43, respectively, for Group I. It was found to be 5.14±0.47, 2.41±0.8 and 2.17±1.01, respectively for Group II. For group III it was 5.16±0.48, 2.56±1.03 and 2.44±0.96, respectively. ***(Table-1)***

Intragroup comparison (Table-1)

Group I, Group II and Group III

The mean difference in PPD at 1 month was found to be statistically significant (p=0.001) as compared to baseline. The mean difference in PPD at 3 month was found to be statistically significant (p=0.001) as compared to baseline.

Intergroup comparison (Table-2)

However, for Group I and Group II the difference in PPD mean values were statistically non-significant at baseline (p= 0.6838), 1 month (p=0.8897) and 3 months (p= 0.5004). The difference in PPD mean values were non-significant at baseline (p=0.4985), 1 month (p= 0.9263) 3 months and (p=0.497) for Group I and Group II. For Group II and Group III, statistically non-significant values were observed at baseline (p=0.8025), 1 month (p= 0.781) and 3 months (p= 0.1184).

Clinical Attachment Level

The mean clinical attachment levels at baseline, 1 month and 3 months were 5.18±0.55, 2.78±1.46 and 2.62±1.43, respectively, for Group I. It was found to be 5.48±1.15, 2.74±1.23 and 2.55±1.42, respectively, for Group II. For group III it was 5.37±0.93, 2.79±1.32 and 2.57±1.17, respectively. ***(Table-1)***

Intragroup comparison (Table-1)

Group I, Group II and Group III

The mean difference in CAL at 1 month was found to be statistically significant (p=0.001) as compared to baseline. The mean difference in CAL at 3 month was found to be statistically significant (p=0.001) as compared to baseline.

Intergroup comparison (Table-2)

The mean difference in CAL values between Group I and Group II was statistically non-significant at baseline (p=0.4687), 1 month (p=0.7471) and 3 months (p= 0.7697). For Group I and Group III mean values difference were statistically non-significant at baseline (p=0.4028), 1 month (p=0.6914) and 3 months (p=0.8016). For Group II and Group III, mean values were statistically non-significant at baseline (p=0.9525), 1 month (p=0.8895) and 3 months (p=0.537).

DISCUSSION

Periodontitis is one of the most prevalent chronic diseases in the world with primary etiological agent being pathogenic bacteria in the subgingival area. Conventional periodontal therapy consists of mechanical debridement to disrupt the subgingival microbiota. However, comprehensive mechanical debridement of sites with deep periodontal pockets is difficult to accomplish. This has led to the adjunctive use of antimicrobial agents delivered either systemically or locally. So, the idea of subgingivally applying a highly concentrated antimicrobial agent as an adjunct to SRP was to compensate for the shortcomings of the systemic antibiotics, thereby improving the treatment outcome.[9] Topical subgingival application of antimicrobial agent (LDD) with SRP may show an improvement in deep sites also.[10] The aim of the present study was to evaluate the efficacy of curcuma longa and chlorhexidine gel as an adjunct to SRP in patients suffering from chronic periodontitis. 90 sites were treated in different patients in different quadrants of mouth. Detailed case history was recorded and a signed informed consent was obtained from every patient. Acrylic stent was prepared to standardize probing depth for selected sites having pocket depth ≥5mm for all patients. Patients were randomly divided into three groups. GR I - Curcumin® + SRP, GR II- Hexigel® + SRP, GR III- Control (SRP alone). The clinical parameters recorded were PI, GI, PPD and CAL. Scaling and root planing was carried out for all patients. In selected sites in additive on to SRP, local drug (Curenext® or Hexigel®) was delivered. Patients were recalled after 1 month and 3 months & the change in clinical parameters from baseline were recorded.

The present study concluded that local drug delivery system either in the form of CHX gel or Curcumin gel can be used effectively as an adjunct to SRP than SRP alone in the treatment of periodontitis.[11] It was concluded that Curcumin and CHX displayed similar periodontally beneficial results but CHX gel edged over Curcumin gel in terms of PI, GI, PPD & CAL scores. This is in accordance with studies conducted by Vibha et al, Jaswal *et al* and Mishra *et al*, they too found CHX to be a better choice for LDD compared to turmeric due to its better anti-inflammatory, antiplaque and antibacterial effects. In contrast to these above studies, Anitha *et al* reported better effect for curcumin at 30 days over chlorhexidine in reducing the microbial load with fewer side effects. The reason postulated was due to curcuma longa's anti-inflammatory, antiplaque and antigingivitis effect.[12]

In the present study, the LDD application was done only once & its effect were evaluated for the ensuing 3 months. Other studies evaluating CHX as an LDD agent evaluated it in the form of a chip and owing to its sustained releasing property it was expected to stay in the periodontal pocket for a longer period.[13,14] The present study used CHX and Curcumin in the form of gel delivered via injectable device. Hence the present study is different in the form that the locally delivered agent was utilized in terms of penetration of a sufficient volume of the gel. Technical difficulties were encountered in deep periodontal pocket. Results of the present investigation also showed that PI, GI, PPD and CAL were improved for all the groups after one month and three months and the difference in improvement was statistically significant for all groups except PI for Group-I and Group-III at 3rd month. Though PI score for Group-I and Group-III at 3rd month worsened compared to the first month but the impact of this change in the plaque scores hardly influenced the other parameters (GI, PPD & CAL). Compared to CHX, Curcumin may not be the best option for LDD system but Curcumin as a Local drug delivery agent showed optimum clinical improvement in periodontal condition[15]. This was in accordance with previous well established findings[16]. Curcuma longa being an ayurvedic herb

is an excellent alternative to chlorhexidine due to minimal side effects. Moreover, Kandwal *et al* also reported regarding better acceptance of turmeric gel over chlorhexidine due to pleasant odor and negligible staining of the teeth.[17] Vikrant Sharma and Devinder Singh Kalti in 2016 concluded that oral formulation containing *C. longa* extract is effective in treating early infective-inflammatory periodontal diseases not only when used as an adjunct to SRP but also when used alone. Their findings clarified the potential benefits of Curcuma Longa as a Local drug delivery system in the treatment of periodontal diseases. It is conclusively known that all the above mentioned mediators play a pivotal role in initiation and progression of periodontal inflammation and periodontal tissue destruction.[18] The existing literature regarding curcuma longa points towards an additional immunomodulatory action, which is absent in chlorhexidine. This novel property may be utilized in developing a stronger formulation which may potentially benefit in both the above mentioned mechanism (antiseptic and immunomodulatory). Sugumari *et al* reported the use of 0.2% curcumin strip compared to SRP alone.[19] Antioxidant property of curcumin helps in inhibiting activity of inflammatory enzymes.[20] At the end of the study, it has been observed that there have been certain aspects, which demanded more detailed observation and elucidation of the data and facts. It is highly desirable to carry forward this study with more sample size having periodontitis, so that a definitive role of curcumin and chlorhexidine can be Data so collected were recorded in a data collecting sheet established as local delivered drugs.

CONCLUSION

From the results of this study it can be concluded that both chlorhexidine gel and curcuma longa gel displayed similar periodontally beneficial results at the end of 3 months. But chlorhexidine gel edged over curcuma longa gel in terms of PI, GI, PPD and CAL scores. Thus, although chlorhexidine remains the LDD of choice, curcuma longa can be used as an excellent alternative to chlorhexidine whenever required.

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Conflict of Interest- Nil

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