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Effects of Chlosite as an adjunct to Scaling and root planing inthe management of chronic periodontitis

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ABSTRACT: In case of localized, non responding and recurrent periodontal pockets, local application of antimicrobials is indicated. Present study was conducted to evalaute the effect of asubgingivally administered broad spectrum antimicrobial agent, namely Chlo-site (Xanthan-based chlorhexidine gel),on gingival inflammation, probing pocket depth, clinical attachment level and bacterial colony countwhen used as an adjunct with scaling and root planing. A total of 50 sites in 32 subjects with chronic periodontitis were included. Sites were divided in to control (n= 24, treated with scaling and root planing) and test (n=26, treated with Chlo-site as an adjunct with scaling and root planing). Periodontal parameters considered were gingival inflammation, probing pocket depth and clinical attachment level (clinical) and the bacterial colony count (microbiological) were recorded on day 0and day 30.Improvement in all the clinical parameters was noted on day 30in both control and test sites, though the difference was not statistically significant. The bacterial colony count on day 30 was noted to be reduced significantly in testsites compared to that of the control. We may conclude that sub gingival administration of Chlo-sitein adjunctive with scaling and root planing improvesthe outcome of periodontal therapy both clinically and microbiologically.

KEYWORDS: periodontitis, periodontal therapy, scaling, root planing, chlorhexidine, Chlo-site, local drug delivery.

I. INTRODUCTION

Periodontal disease is recognised as a major public health problem throughout the world and is one of the most common cause of tooth loss in adult population (Nuvvula et al., 2015). It represents a group of inflammatory diseases which occurs primarily as a host-microbial interaction. The bacteria predominantly responsible for the pathogenesis of periodontal diseases are Aggregatibacteractinomycetemcomitans, Porphyromonas gingivalis, Tanerella forsythia, Treponema denticola, Prevotella intermedia, Fusobacterium nucleatumetc.,. They exist deep in the periodontal pocket which provides a favourable environment for their existence (Newman et al., 2012). They increase in numbers and invade the periodontal tissues either directly through the production of enzymes and toxins or indirectly by inducing inflammatory responses in the host tissue (Slots& Genco, 1984; Kesic et al., 2008; Newman et al., 2012). The net result of these interactions is the breakdown of periodontal ligament fibers that lead to clinical loss of attachment and resorption of the alveolar bone (Newman et al., 2012).

The primary goal of periodontal therapy is to effective elimination of bacterial plaque as well as the factors that favour its formation and accumulation.This may be achieved by nonsurgical and surgical periodontal therapies. In a vast majority of patients with periodontal diseases, nonsurgical therapies, namely scaling and root planing coupled with a thorough oral hygiene maintenance program is often sufficient in reducing the bacterial load and halting the disease progression. However, about 20%–30% of patients with chronic periodontal disease do not respond fully to conventional treatment alone (Hirschfeld & Wasserman, 1978). It may be due to an inadequacy of the host's immune response, the ability of the pathogen(s) to escape either by invading gingival epithelial cells and subepithelial connective tissue or finding shelter in areas with limited approachability to instrumentation (e.g.deep pockets, furca areas, root concavities and grooves), or a multitude of other possible factors, which further results in recurrence of the condition (Cobb, 1996; Shaddox & Walker, 2010). In such situations, chemotherapeutic agents are used systemically or locally as adjuncts to nonsurgical therapy. Systemic administration of many

antibiotics may lead to development of antibiotic resistance, adverse drug interactions and other side effects, and reduced patient compliance. Moreover, the concentration of drug attained in gingival crevicular fluid is insufficient due to metabolism of drug in systemic circulation. These limitations have led to the introduction of local drug delivery (LDD) of antimicrobial agents at specific sites (Greenstein and Polson, 1998; Norkiewicz et al., 2001; Soskolne et al., 2003; Umeda et al., 2004; Shaddox and Walker, 2010).In local drug delivery system, antimicrobial agents are placed directly into the periodontal pocket through which 100-fold higher concentration of the agent is attained locally compared to that of the systemic drug administration. Antimicrobial agents are incorporated into a continuous-release system that delivers high drug concentrations directly into the periodontal pocket. These include hollow fibers containing tetracycline HCl and biodegradable-release systems containing metronidazole, doxycycline, minocycline, chlorhexidine,etc. (Gupta et al., 2008; Kranti et al., 2010).One of such agents is xanthan-based chlorhexidinegel, Chlo-site(Ghimas Company, Italy)available as syringable gel.Chlo-site is based on two forms of chlorhexidine bonded in a xanthan carrier substance. Xanthan gum is a polysaccharide that consists mainly of galactose and mannose residues. One of the most remarkable properties of xanthan gum is its capacity to produce a large quantity in the viscosity of a liquid. Xanthan gum provides the most prolonged adhesion time on oral mucosa with respect to other delivery vehicles.The two forms of chlorhexidine are chlorhexidine digluconate and chlorhexidine dichloride. Chlorhexidine digluconate (0.5%) is a smallmolecule released in higher concentrations immediately after placement and achieves a concentration more than 100 µg/ml,which is maintained for an average of 6-9 days. This concentration is greater than its minimum inhibitory concentration (0.10 µg/ml) against pathogenic bacteria.While chlorhexidinedichloride (1%) is larger and more complex molecule that is released over a period of more than 7-8 days at a consistent level,which is 20 times more than that of the minimum effective dosage to maintain its anti-microbial properties(Gupta et al., 2008; Kranti et al., 2010). The cationic charges of chlorhexidine can interact with the anionic charges of the xanthan gum polymer, enhancing its gel structure and substantivity (Needleman et al., 1997).

Various studies have opined that subgingival administration of antimicrobial agents as an adjunct to SRP showed superior clinical results in terms of reduction inprobing pocket depth, gain in clinical attachment especially in non responding sites or with recurrent disease.Considering this fact, present study was conducted to assess the effect of Chlo-site on bacterial colony count in adddition to its effect on gingival inflammation, probing pocket depth and clinical attachment level when it is administered subgingivally as an adjunct to SRP in the patients with moderate to advanced chronic periodontitis.

II. MATERIALS AND METHODS:

A total of 50 sites withchronic periodontitis in 32 subjects of both male and female of age group of 25-46 years were selected from the Out Patient Department of Periodontics, Regional Dental College and Hospital, Guwahati-32, Assam. The study was conducted as a randomized controlled clinical trial. The procedure was fully explained to all the participants and written consent was obtained from all of them.Permission from Institutional Ethical Committee was obtained to conduct the study. Subjects were selected on the basis of following criteria:

Incusion criteria:

- Systemically healthy subjects
- Subjects who did not receive any antibiotics/surgical or non-surgical periodontal therapy in the past three months
- Presence of at least two sites in the same arch with pocket depth ≥ 5mm that bleed on probing

Exclusion criteria:

- Subjects allergic to chlorhexidine
- Smokers
- Pregnant and lactating mother
- Teeth having any restoration with large cavity, over-hanging or any type of full crown
- Teeth with furcation invovement
- Teeth with a fixed prosthesis
- Teeth with periapical lesion
- Malformed, malaligned and crowded teeth

Clinical parameters:

- Gingival Index (GI)
- Probing pocket depth (PPD)
- Clinical attachment level (CAL)

Microbiological parameter:

Bacterial colony count was done for both aerobic and anaerobic organisms.

Subjects were selceted based on the inclusion criteria. Supragingival scaling was carried out followed by oral hygiene instructions.

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After selecting the sites, study cast was prepared for each subject. Occlusal acrylic stents were fabricated on each cast to fit over the occlusal one third of the teeth selected for the study. A groove was cut in the acrylic stent at the site of deep pocket, so that probe could be inserted at a standardized point of entry into the pocket at subsequent visits to measure probing depth and clinical attachment level.

The subjects were recalled after three weeks to record the baseline readings (day 0), which were recorded again on day 30.

The sites selected were classified into two groups, based on the treatment received:

- Group I: treated with scaling and root planning (SRP), considered as control sites.
- Group II: treated with Chlo-site as an adjunct to SRP (test sites).

Gingival index (Loe and Silness, 1963):

The gingival health status was assessed using a mouth mirror and a periodontal probe. It was scored on a numerical scale, according to the following criteria (Newman et al., 2012):

Score 0: Normal gingiva

Score 1: Mild inflammation, slight change in color, slight edema, no bleeding on probing

Score 2: Moderate inflammation, redness, edema, and glazing; bleeding on probing

Score 3: Severe inflammation, marked redness and edema, ulceration; tendency to spontaneous bleeding

The Gingival score for a tooth was obtained by dividing the sum of scores obtained at four areas by four.

Probing pocket depth (PPD):

It was measured using the UNC-15 periodontal probe. The working end of this probe is 15 mm long with markings at each millimeter and colour coding at 5^{th}, 10^{th} and 15^{th}mm. The probe was inserted with a firm, gentle pressure (0.75 N) to the bottom of the pocket aligning the shank with the long axis of the tooth surface to be probed. Probing pocket depthwas measured from gingival margin to base of the pocket in mm, at four specific points in relation to a tooth: distofacial and mesiofacial line angles, middle of facial and lingual surfaces.

Probing pocket depth of each tooth was obtained by dividing the sum of depth obtained at four areas by four.

Clinical Attachment Level:

It was measured using an 'Occlusal Stent'. Clinical attachment level is measured using UNC - 15 from coronal border of the stent (fixed reference point) to the base of the pocket. The probe was kept on the vertical grooves prepared on the occlusal stent to avoid clinical variations at different time points of measurement (Clark et al., 1987).

Bacterial Colony Count (BCC):

Collection of the plaque sample:

The subgingival plaque was collected from the sites according to the protocol given by Perinettiet al., (2004):

The selected sites were isolated with cotton rolls and supragingival plaques were removed with a sterile curette. The gingival surface was allowed to dry. The plaque samples were obtained inserting sterile paper-points (no.30) into the deepest part of each periodontal pocket and keptin situ for 15 seconds to saturate.The paper-points containing the plaque samples were then put into the sterile Thiogly collate broth/Phosphate Buffer Saline and were processed in the laboratory immediatelyfor culturing technique and microbiological analysis. (Figure 1).

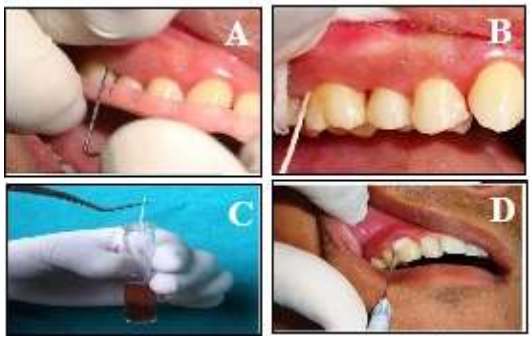

Figure 1:A. measurement of clinical attached level using UNC-15 periodontal probe keeping its shank parallel with the long axis of the tooth along the groove prepared on the occlusal stents. B. Collection of subgingival plaque sample. C. Placement of saturated paper-pointscontaining plaque samples into the sterile Phosphate Buffer Saline. D. Application of Chlo-site gel.

Each specimen was cultured on two blood agar plates; one incubated aerobically at37° C for 24 hours and the other anaerobically for 48 hours. Selective media used were blood agar with kanamycin and vancomycin forBacteriods; and blood agar with neomycinfor Fusobacteria, and placed in a Hi Anaerogas Pack Jarcontaining 10% CO_2(Hi Media, Mumbai) for 48 hours. Colonieson anaerobic blood agar plates which showedGram-negative short Fusoform to filamentous shapes were presumptively identified as Bacteroids or Fusobacteria. Average colony counts were

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measured separately in the plates incubated aerobically and anaerobically.

Viable count per ml of original sample (CFU/ml) was calculated by multiplying the average colony count per plate by dilution factor.

The full mouth SRP was carried out in a single sitting to make the mouth free of soft and hard deposits. As an adjunct to SRP, Chlo-site was applied into the sites of periodontal pocket (test site)followed by application of Coe-Pak (on day 0) and the subjects were recalled after 10 days for removal of the Coe-pak.Subjects of the both groups were recalled in every 10 days up today 30 to make sure that they maintain proper oral hygiene.

All the clinical parameters were recorded and the plaque samples were collected in similar fashion as on day 0 and sent for analysis. The colonies were counted after 24 hours and 48 hours of the incubation of the bacterial culture for the aerobic and the anaerobic accordingly.

The data collected were analysed statistically. Student's t-test was used to compare the mean values of different clinical parameters. Chi-Square test was used to measure the significance of the distribution of the elevated or reduced bacterial colony counts.

III. RESULTS:

The mean gingival index, probing pocket depth and clinical attachment level of both cotrol and test sites is depicted in Table 1.

Gingival index (GI):

In control sites, the mean GI was found to be 0.71 (± 0.55) and 0.23(± 0.10) on day 0 and 30, respectively. While in test sites, the mean GI was 1.26 (± 0.77) on day 0, which was reduced to 0.30 (± 0.44) on day30 (Table1). Thus, the difference inGI between day 30 and 0 in both control and test sites was found to be highly significant (p<0.01).The mean difference in GI was greater in test sites (76.19%) compared that of the control sites(67.60%), though the difference in between the test and control site was not significant statistically.

Probing pocket depth (PPD):

The mean PPD in control and test sites are presented in the Table 1. In control sites, the PPD was found to be 4.38 (± 0.71) on day 0, which was reduced to 3.04 (± 0.81)(30.59%) on day 30. In test sites, the mean PPD was found to be 5.08 ± 1.23on day 0, which was reduced to 3.37 ± 1.31 on day 30, i.e. (33.66%). The difference in PPD between day 30 and 0 in both control and test sites was found to be highly significant (p<0.01), though intragroup difference was not significant statistically.

Clinical attachment level (CAL):

In control sites, the mean CAL was found to be 8.33 ± 1.71 on day 0, which was reduced to 7.00 ± 1.69) on day 30. In test sites, the mean CAL was found to be 10.19 ± 1.65on day 0, which was reduced to 8.48 ± 1.80 on day 30.The percentage in gain in CAL was 15.96% and 16.78% in control and test sites, respectively. The difference in CAL within the group and in between the groups at different time point was found to be not significant statistically(Table 1).

Bacterial colony count (CFU/sample):

In control sites, the mean number of aerobic bacterial colony was found to be 85816 ± 8630 and 35281 ± 7228on day 0 and 30, respectively. In the test sites, the mean number of aerobic bacterial colony was found to be 93230 ± 3466 on day 0, which was reduced to 9627 ± 2358on day 30.

The difference in bacterial colony count between day 30 and 0 in both control and test sites was found to be very highly significant (p<0.001). A greater reduction in bacterial colony count is observed in test sites (89.67%) compared to that of control sites (58.88%), which is statistically highly significant (p<0.01).

However, we failed to grow the anaerobic bacterial culture.

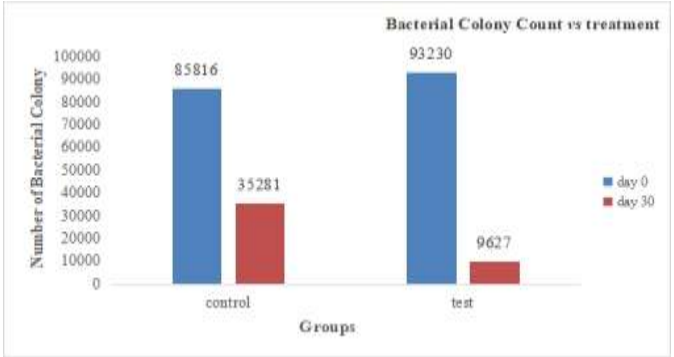

Figure 2: Mean Bacterial Colony count on day '0' and day '30'

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Tables 1: Mean Gingival Index (GI), Probing pocket depth (PPD) and Clinical attachment level (CAL)in control and test sites on day 0 and 30

Sites	Gingival index		Probing pocket depth		Clinical attachment level	
	Day 0	Day 30	Day 0	Day 30	Day 0	Day 30
Control(n = 24)	0.71± 0.55	0.23± 0.10	4.38± 0.71	3.04 ± 0.81	8.33± 1.71	7.00 ± 1.69
Test(n = 26)	1.26± 0.77	0.30± 0.44	5.08± 1.23	3.37± 1.31	10.19 ± 1.65	8.48 ± 1.80

IV. DISCUSSION:

The most important goal of periodontal therapy is to reduce or eliminate the causative sub gingival microorganisms to attain periodontal health and further facilitates the maintanance of periodontal health and if possible, to regenerate the lost tissues. SRP is considered as gold standard to attain its goal of periodontal therapy. SRP removes the biofilm, which are extremely resistant to subgingival administration of pharmacological agents. Thus, removal of the biofilm prior to antibiotic therapy could provide a favourable environment for greater effectiveness of these medications (Kranti et al. 2010). This supports the need of SRP conducted in the present study.

Along with SRP, chlorhexidine is used widely as an adjunctive agent. Chlorhexidine gluconate is an active agent against broad spectrum microorganisms. Because of its positive charge, chlorhexidine molecule directly reacts with the microbial cell surface and results in cell lysis through precipitation of the cytoplasm (Ciancio, 1999).With the intention to increase the retention of chlorhexidinemolecule in the periodontal pocket, Chlosite, a xanthan-based product is developed (Paolantonioet al, 2008). The present study was conducted to evaluate the effect of subgingival administration of Chlositeas an adjunct to SRP (test sites) in the management of chronic periodontitis at clinical and microbiological levels.

Improvement in GI, PPD and CAL was observed on day 30 compared to that of day 0 in both the control and test sites. Similar results have been reported by Stratul (2005); Paolantonioet al., (2009); Krantiet al., (2010)using controlled release Xanthan-based 1.5% Chlorhexidine gel as an adjunct to SRP (Soskolneet al., 2003; Perinettiet al., 2004; Rusu et al, 2005; Stratulet al., 2005; Quirynen et al, 2006; Paolantonio et al., 2008; Krantiet al. 2010). In this respect, sites treated with Chlo-site showed slightly higher clinical attachment level gain and periodontal pocket depth reduction than the SRP sites, which may be due to improved bioadhesive properties of thismaterial and its prolonged substantivity.However, the difference between test and control sites was not statistically significant, which may be related to the lower number of cases (Stratulet al, 2005).

Clinical attachment level is one of the most practical methods of determining the progression of periodontal disease. Therefore, we have considered this parameter here to evaluate the effect of Chlo-site in chronic periodontitis.

Even though we tried for aerobic and anaerobic culture, we could obtain only the aerobic culture. This may be related toyield of smaller amount of energy from oxidizing organic molecules than that of aerobes. Moreover, ubiquity on their mucocutaneous surfaces often interferes with their growth (Baron, 1996).

In the present study, microorganisms were found to be reduced at a greater level after application of Chlo-site gel as an adjunct toSRP compared to the sites treated with SRP alone. Our findings support the observation of various previous reports (Fine et al, 1994; Unsalet al., 1995; Piccolomini et al.,1996;Cuginiet al, 2000; Umedaet al, 2004; Papakonstadinuet al, 2008; Hossamet al, 2010), who observed improvement in clinical parameters and greater reduction in the number of periodontopathic micro organisms than using SRP alone.

However, the present findings are in contradiction with the observations of Vinholiset al. (2001) and Grisi et al., (2002) on the effects of sub gingival administration of chlorhexidine as an adjunct to SRP.

V. CONCLUSION:

In the light of the present study, we may conclude that adjunctive subgingival administration of Xanthan-based chlorhexidine gel, Chlo-site, with SRP may improve the outcome of the periodontal therapy. However, further clinical and microbiological studies are required to evaluate the long-term clinical application of Chlo-site gel in the treatment of chronic periodontitis with deep periodontal pockets.

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