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Original Research

A comparative study to evaluate the efficacy of chlorhexidine gluconate chip and diode laser as adjunct to scaling and root planing

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ABSTRACT:
Suppression of pathogenic microflora is of utmost importance for maintenance of periodontal health. Scaling and root planing though considered as the gold standard for the eradication of the same has its own limitation when used alone. Thus the main **AIM** of our study was to compare and assess the clinical effectiveness of two different treatment options (diodes and chlorhexidene chips) when used in conjugation with scaling and root planning in chronic periodontitis patients. **Material and methodology**: 45 sites in 15 random patients were selected on the basis of inclusion criteria from the subjects visiting the department of Periodontology. These sites were randomly divided into three groups on the basis of the procedure done. In group A 15 sites were included where only scaling and root planning was done, in group B with 15 sites scaling and root planing along was chlorohexidene chip placement was don and in group C with 15 sites scaling and root planning was followed by diode laser lasing. Periodontal parameters including gingival index, bleeding index, probing depth and clinical attachment level were assessed at baseline, after 1 month and 3 months of the study. **Results**: the values obtained from the baseline and follow up time period were recorded and statistically analyzed. The categorical parameters were assessed using mean, frequencies, percentages and standard deviation while the descriptive inter and intra group comparison was done using repeated ANOVA along with Post Hoc Tukey test with p of less than 0.05 as statistically significant. Chlorhexidene chips (Group B) when used in conjugation with scaling and root planing showed greater improvements in all the clinical parameters with statistically significant results when compared with Group A and Group C. **Conclusion**: within the limitations it can be concluded that chlorhexidene chip is the safest and most effective drug with greater promise for treatment and as maintenance therapy in patients with peridontitis.
Keywords: Chronic periodontitis, chlorhexidene chip, diode laser, local drug delivery, periodontal parameters**.**

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INTRODUCTION

Chronic inflammation of the supporting structures of teeth are widely known to be caused by micro-organisms present in the dental plaque leading to progressive attachment and bone loss along with the formation of periodontal pockets and recession of the gingiva.[1] Periodontal pathogens evade the host responses usually by liberating various virulence factors in and around the surrounding environment which inturn cannot be completely eradicated with non surgical periodontal therapies alone.[2] Though the main purpose of periodontal therapy has always aimed at maintain the health and integrity of the attachment apparatus. Various recurrent periodontal destructing diseases usually become almost inevitable in patients who fail to achieve and maintain an acceptable periodontal therapy.[3]

In the vast majority of cases, scaling and root planing (SRP) can result in significant clinical improvement using a variety of dental tools, including ultrasonic instruments and hand instruments.[4] However, mechanical therapy alone may not be sufficient to eliminate the subgingival pathogenic bacteria that are located in areas that are inaccessible to periodontal instruments. In periodontal pockets with a depth of 3.73 mm or less, manual instruments cannot

effectively remove subgingival dental plaque and calculus, and instruments are ineffective in periodontal pockets with a depth of 5.7 to 8.3 mm.[5] Thus, a number of newer techniques and approaches have been used which may represent a potential benefit in the treatment of periodontitis by decreasing and eliminating certain pathogens present deep inside the periodontal pockets.

One such approach is use of local drug delivery device which comprises of a limiting element and a drug reservoir which controls the rate of release of medicine. Local administration of antimicrobial drugs directly into the periodontal pocket has been suggested as a means of by passing systemic complications and targeting localized areas of periodontal destruction. A higher concentration of the active agent is maintained at the site of activity for longer periods of time despite its loss from the clearance of crevicular fluid. Among the number of local delivery agents used, chlorhexidene in the form of Periochip has proven to be the most effective, clinically effectual and safest of the all chemical plaque controlling agents used in reducing plaque and gingival indices.[6] The effectiveness of the chlorhexidene chip has been confirmed by a number of studies. It has been found that the average concentration of chlorhexidene in the gingival crevicular fluid stays above 125 mg/mL for eight days and inhibits 99 percent of the bacteria that are isolated from periodontal pockets.[7] Besides so many advantages the use of chlorhexidine chip is still questionable in smokers and medically compromised patients. Therefore, other treatment modalities such as laser and photodynamic therapy can also serve as adjunctive treatment option in periodontally diseased patients.

Lasers have been used for calculus removal, bacterial reduction in periodontal pockets, soft tissue management, gingival curettage and melanin pigmentation removal. Moreover, it is an excellent hemostatic agent and can be used for cutting and coagulating gingiva and oral mucosa. The use of low level laser light and a non toxic photo activated dye (photosensitizer) helps in binding to the target cells where the reactive state of photosensitizer is excited when it is photoactivated, resulting in the production of reactive oxygen species that harms the target microbial cells.[8] Recent studies have demonstrated that a number of oral bacteria are susceptible to red laser in the presence of photosensitizers like toluidine blue O, methylene blue, and malachite green, indicating that PDT is beneficial in periodontal therapy.[9] Lasers have been studied for use in promoting periodontal attachment, elimination of bacteria from periodontal pockets, debridement of root surfaces and treatment of dentinal hypersensitivity. Low level lasers can achieve good tissue ablation with strong bactericidal effects and thus it is one of the most promising approaches for nonsurgical periodontal treatment.[10] Thus the aim of the present study was to assess the clinical effectiveness of a controlled release biodegradable PerioCol^{R} – CG I.P 2.5mg chlorhexidine chip and diode laser as an adjunct to scaling and root planing and scaling and root planing alone in reducing probing pocket depth, improving bleeding scores and clinical attachment level in patients with moderate chronic periodontitis.

MATERIAL AND METHODOLOGY

A split mouth technique was done on randomized 15 patients with moderate periodontitis visiting the outpatient department of Periodontology, BRS Dental College and Hospital, Sultanpur, Panchkula. Subjects with probing depth in the range of 5-8 mm in a maximum three quadrants were included in the study. Before any inclusion of the subjects in the study, a short discussion about the aim, advantage and follow up time was informed and whoso ever willing for the same were included. Ethical approval for the study was obtained from the institutional ethical committee and an informed consent was taken from each subject.

A minimum of 15 teeth should be present with atleast one inter-proximal site involvement in each quadrant. Non smokers, cooperative and systemically healthy subjects were included in the study. While patients, who have undergone any form of surgical or non-surgical periodontal therapy, are on any kind of medication and/or are using any form of chemotherapeutic mouth rinses subsequently from six months were not included in the study.

PROCEDURE

All the patients were examined and treated by the single observer only to avoid any form of biasness. Clinical parameters namely plaque index, gingival index, periodontal probing depth and clinical attachment levels were assessed and recorded in all the patients selected. Full mouth supragingival hand scaling (Hu-friedy scalers) was done followed by alginate impression for fabrication of acrylic stent. The thickness of the stent was about 2-3 mm in all the cases and a groove was made which acted as guide plane for future examinations. Oral hygiene instructions were given to the patient and were recalled after one week for the baseline examination.

Patients were recalled were examined and all the clinical parameters were measured and recorded. The subjects were then randomly assigned in one of the three groups. In group A (15 sites) scaling and root planing was done alone (fig 1), in group B (15 sites) scaling and root planing was followed by application of a degradable drug delivery system containing chlorohexidene gluconate I.P 2.5mg chip (Periocol^{R}-CG) (fig 2) and in group C (15 sites) scaling and root planing was followed by the use of diode laser (Picasso Laser System) (fig 3). In group C lasing was done with a diode laser which had a thin flexible light guide of 0.4 mm diameter and 805 nm of wavelength. All periodontal pockets in this group were lased at an

output power of 0.8 W in a non-contact pulse mode. The depth of the particular periodontal pocket typically determines how long lasing should be done while the exposure time is directly proportional to the pocket depth in millimeters. Patients were then instructed to perform oral hygiene practices normally and to avoid floss, any chemotherapeutic mouth-rinse or oral irrigation devices. Patients were then requested to report back in case of dislodgement of chip within 2 days.

Patients were recalled for follow up after 1 and 3 months from baseline for recording clinical parameters. Patients were also instructed to contact the department in case of sensitivity, swelling, local pain or any other adverse reaction (fig 4).

Fig 1: SCALING AND ROOT PLANING

fig:2 CHX- CHIP PLACEMENT

Fig: 3 LASER APPLICATION

Fig 4: Post-Operative Assessment at Baseline, 1Month and 3 Months using Custom made Acrylic Stent

AT BASELINE **AFTER 1 MONTH** **AFTER 3 MONTHS**

STATISTICAL ANALYSIS

The parameters recorded were compiled and transferred to SPSS software (Inc., Chicago, IL, version 15.0 for Windows) for statistical analysis. The quantitative variables were measured and calculated using mean and standard deviation while inter and intra group comparison was done using Repeated Measures of ANOVA and Post Hoc Tukey test. The p value of <0.05 was considered to be statistically significant and <0.001 as highly statistically significant.

RESULTS

On evaluating the data obtained from the study following inferences can be seen:

1. **GINGIVAL INDEX (table 1):** on comparison from baseline to 1 month, statistically non significant results ($p \leq 1.000$) were obtained with the mean difference of 0.200±0.291, 0.000±0.291, 0.200±0.291 respectively between groups A and group B; group B and group C; and group A and group C. On comparison from baseline to 3 months, statistically non significant

values (p≤1.000) were obtained with the mean difference of 0.133±0.264, 0.200±0.264 and 0.066±0.264 between group A and group B, group B and group C and group A and group C respectively. When compared from 1 month to 3 month statistically non significant values with a mean difference of 0.066±0.331 (p≤1.000), 0.200±0.331 (p≤1.000), and 0.266±0.331 (p≤1.000) were obtained when evaluated between group A and group B, group B and group C and group A and group C respectively.

TABLE 1: Comparative Analysis of Change in Mean Difference Values of Gingival Index From BL to 1 M, BL to 3m and 1Mto 3M Post-Treatment in Group A (SRP), Group B (SRP+CHX CHIP) And Group C(SRP + LASER)

Dependent Variable	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
(BL-1)	Group A (SRP)	Group B (SRP + CHX)	0.20000	0.29168	1.000	0.9274	0.5274
	Group B (SRP + CHX)	Group C (SRP + LASERS)	0.00000	0.29168	1.000	0.7274	0.7274
	Group A (SRP)	Group C (SRP + LASERS)	0.20000	0.29168	1.000	0.9274	0.5274
(BL-3)	Group A (SRP)	Group B (SRP + CHX)	0.13333	0.26427	1.000	0.7923	0.5257
	Group B (SRP + CHX)	Group C (SRP + LASERS)	0.20000	0.26427	1.000	0.4590	0.8590
	Group A (SRP)	Group C (SRP + LASERS)	0.06667	0.26427	1.000	0.5923	0.7257
(1-3)	Group A (SRP)	Group B (SRP + CHX)	0.06667	0.33174	1.000	0.7606	0.8939
	Group B (SRP + CHX)	Group C (SRP + LASERS)	0.20000	0.33174	1.000	0.6273	1.0273
	Group A (SRP)	Group C (SRP + LASERS)	0.26667	0.33174	1.000	0.5606	1.0939

2. **PERIODONTAL PROBING DEPTH (table 2):** the mean difference in probing depth between group A and group B; group B and group C was found to statistically significant while between group A and group C non significant results were obtained when compared from baseline to 1 month. On comparison from baseline to 3 months similar results were obtained between group A and group B; group B and group C, while non significant results were obtained between group A and group C. while on comparison from 1 month to 3 month statistically non significant values were obtained in all the three groups.

TABLE 2: Comparative Analysis of Change in Mean Difference Values of Probing Pocket Depth From BL to 1 M, BL To 3M and 1M to 3M Post-treatment in Group A (SRP), Group B (SRP+CHX) and Group C (SRP + LASER)

Dependent Variable	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
(BL-1)	Group A (SRP)	Group B (SRP + CHX)	1.26667*	0.34854	0.002	0.3975	2.1358

	Group B (SRP + CHX)	Group C (SRP + LASERS)	0.93333*	0.34854	0.032	0.0642	1.8025
	Group A (SRP)	Group C (SRP + LASERS)	0.33333	0.34854	1.000	0.5358	1.2025
(BL-3)	Group A (SRP)	Group B (SRP + CHX)	1.00000*	0.3541	0.022	0.1238	1.8862
	Group B (SRP + CHX)	Group C (SRP + LASERS)	1.13333	0.3541	0.008	0.2529	2.0295
	Group A (SRP)	Group C (SRP + LASERS)	0.13367	0.34541	1.000	0.7595	1.0229
(1-3)	Group A (SRP)	Group B (SRP + CHX)	0.26667	0.29096	1.000	0.4589	0.9922
	Group B (SRP + CHX)	Group C (SRP + LASERS)	0.20000	0.29096	1.000	0.9256	0.5256
	Group A (SRP)	Group C (SRP + LASERS)	0.06667	0.29096	1.000	0.6589	0.7922

3. **CLINICAL ATTACHMENT LEVEL (table 3):** statistically significant results were obtained between group A and group B; group B and group C, while non significant results were obtained between group A and group C when compared from baseline to one month. Similar results were obtained on comparison from baseline to 3 months. Non significant results were obtained in all the three groups when compared from 1 to 3 months.

Table 3: Comparative Analysis of Change in Mean Difference Values of Clinical Attachment Level From BL To 1 M, BL to 3Mand 1M to 3M Postoperative in Group A (SRP), Group B (SRP+CHX) and GROUP C (SRP + LASER)

Dependent Variable	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
(BL-1)	Group A (SRP)	Group B(SRP + CHX)	1.13333*	0.33365	0.005	0.3013	1.9653
	Group B (SRP + CHX)	Group C (SRP + LASERS)	1.00000*	0.33365	0.014	0.1680	1.8320
	Group A (SRP)	Group C (SRP + LASERS)	0.13333	0.33365	1.000	0.9653	0.6987
(BL-3)	Group A (SRP)	Group B(SRP + CHX)	1.40000*	0.36976	0.001	0.4780	2.3220
	Group B (SRP + CHX)	Group C (SRP + LASERS)	1.46667*	0.36976	0.001	0.5446	2.3887
	Group A (SRP)	Group C (SRP + LASERS)	0.06667	0.36976	1.000	0.8554	0.9887
(1-3)	Group A (SRP)	Group B (SRP + CHX)	0.26667	0.31673	1.000	0.5232	1.0565
	Group B (SRP + CHX)	Group C (SRP + LASERS)	0.46667	0.31673	0.444	0.3232	1.2565
	Group A (SRP)	Group C (SRP + LASERS)	0.20000	0.31673	1.000	0.5898	0.9898

4. **BLEEDING INDEX (table 4):** In group A, the reduction in the percentage of bleeding sites from baseline to 1 month was 53.3% and from baseline to 3 months was 60%. In group B, the reduction in the percentage of bleeding sites from baseline to 1 month was 80% and from baseline to 3 months was 93.3%. In group C, the reduction in the percentage of bleeding sites from baseline to

1 month was 66.7% and from baseline to 3 months was 68.7%.

TABLE 4: Frequency of Reduction in Bleeding Sites From Baseline to 1 Month And 3 Months Post-treatment in Group A (SRP), Group B (SRP+CHX) and Group C (SRP + LASER)

Group	Baseline	1 Month	3 Months	% Difference (Bl-1)	% Difference (Bl-3)
Group A (SRP)	100%	46.7%	40%	53.3%	60%
Group B (SRP+CHX CHIP)	93.3%	13.3%	0%	80%	93.3%
Group C (SRP+LASER)	100%	33.3%	31.3%	66.7%	68.7%

DISCUSSION

Periodontal diseases, which are bacterial infections, are characterized by inflammation that leads to the breakdown of the attachment apparatus, which frequently results in tooth loss.[11] The most common definition of periodontitis: "it is as inflammatory diseases of the supporting tissue caused by specific micro-organisms, resulting in progressive destruction of the gingival apparatus with pocket formation, recession, or even both".[1]

A thorough understanding of the etiopathogenesis of periodontal diseases has provided the clinicians and researchers with a number of diagnostic tools and techniques that has widened the treatment options. Mechanical debridement i.e scaling and root planing (SRP) remain an essential part of successful periodontal therapy, resulting in significant clinical improvement in deep periodontal pockets.[12] When pocket depth increases, bacterial plaque and calculus can only be removed to a certain extent, especially after 5 mm. Moreover, the use of SRP in the treatment of chronic periodontitis may result in a moderate and temporary shift in the composition of the microbial flora, particularly in deep pockets where periodontopathic bacteria can persist after SRP.[13] This may serve as seeding source for infection leading to recolonization of treated sites. Non-surgical periodontal treatment often fails due to the persistence of bacteria and calculus on the surface of the pockets.[14]

As a result numerous treatment options have been developed over the past few decades. Use of antimicrobial agents supplementing conventional mechanical therapy results in additional clinical improvements in deep periodontal pockets.[15] These antimicrobial agents can be delivered by rinsing, irrigation, systemic administration and local drug delivery system. Chlorhexidine has long been known as an effective antimicrobial agent and has been found to be effective against subgingival bacteria when delivered through a sustained release. Although, chlorhexidine chip has unbeatable success in the management of deep periodontal pockets in chronic periodontitis patients, there is no or very less data present about its success in smokers, medically compromised and aggressive periodontitis patients. Other adjunctive treatment modalities such as laser and photodynamic therapy have also shown promising results in improving clinical parameters in chronic periodontitis patients.

In the present study diode laser was used at wavelength of 805nm and at an output power of 0.8W in a non contact pulse (decontamination) mode.[16] The results of our study were in consistent with the studies conducted by Haffajee et al. 1997[17] after scaling and root planing, by Rodrigues et al in 2007[18] with the use of chlorhexidine chip and Lin et al. in 2011[19] with significant outcome following laser irridation. A study by Pattnaik et al in 2015[20] also reported significantly reduced gingival index scores in SRP and SRP plus chlorhexidine chip group. Studies conducted by Tsai et al in the year 1998[21] and Mizrak et al in 2006[22] suggested that the reduction of periodontal inflammation after chlorhexidine chip application might be attributed to the reduction in prostaglandin E2 levels in the GCF and reduced MMP-8 expression which is a potent indicator of periodontal inflammation. Ribeiro et al in 2008[23]also reported reduction in gingival inflammation and MMP-8 expression, after laser therapy following SRP.

In our study a mean reduction in bleeding index was found with the placement of chlorhexidene chip which are in accordance with Azmak et al in 2002[24], who also reported a mean reduction in bleeding index score at one month and three months for both SRP and SRP plus chlorhexidine chip. While Mortiz et al in the year 1998,[25] and Lin et al in 2011[19] reported significant change in bleeding index scores at 1 month and three months after laser application which were also similar to the results evaluated in the study.

A decrease in periodontal probing depth was also found when the mean difference of group A and group B; group B and group C was evaluated with statistically significant results which was in agreement with a study aimed by Kaldahl et al in 1988.[26] Jeffcoat et al in 1998[27] & Sosklone et al in 2003[28] reported significant decrease in the depth of the probing pocket after SRP plus chlorhexidine chip application. Similar results have been obtained by Yukna et al in 2007[29] who reported a significant reduction in pocket probing depth with increased clinical attachment levels associated with laser therapy in patients with periodontitis.

LIMITATION

The main limitation of our study was sample size, more clinical research trials with larger sample size and longer follow up periods are required to substantiate the degree of efficiency of chlorhexidine chip and role of diode laser as an adjunct to conventional scaling and root planing and to reach at a reasonable level of confirmation.

CONCLUSION

Within the limitations of the present study, it can be concluded that chlorhexidine local delivery is much effective and safest drug in reducing gingival inflammation, probing pocket depth and improving clinical attachment levels in patients with chronic periodontitis receiving non-surgical periodontal therapy as an addition to scaling and root planing.

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