Bulletin of Environment, Pharmacology and Life Sciences
Bull. Env. Pharmacol. Life Sci., Spl Issue [2] 2022 : 272-279

Online ISSN 2277-1808
Journal's URL:http://www.bepls.com
CODEN: BEPLAD

ORIGINAL ARTICLE **OPEN ACCESS**

Comparative Evaluation Of Clinical Efficacy of Subgingivally Delivered Chlorhexidine Gel, Tetracycline Fibers and Diode Laser as an Adjunct To Scaling and Root Planing with Chronic Periodontitis among Smokers.

Shagun Malik[1]*, Anshu Blaggana[2], Abhinav Kathuria[3]
[1,2,3,]Department of Periodontology, Faculty of Dental Sciences, SGT University, Gurugram, *email id - shagun_fdsc@sgtuniversity.org

ABSTRACT
Periodontitis is an inflammatory ailment of the periodontium with specific bacteria among the oral micro-flora as the major causative factor. In search of a more efficient and a traumatic technique which improves periodontal healing, the use of local drug delivery and lasers for periodontal treatment have been proposed. To compare the effectiveness of scaling and root planning alone, scaling and root planning along with Tetracycline fibers, scaling and root planning along with Chlorhexidine gel and scaling and root planning with laser irradiation in treatment of chronic periodontitis among smokers. The sample size selected for the study consisted 80 sites in smokers who presented with chronic periodontitis & exhibiting periodontal pockets ≥4mm, which were randomly assigned to any of the four treatment modality groups: Scaling and root planning (SRP) alone, SRP+Chlorhexidine Gel, SRP+Tetracycline fibers and SRP+Diode Laser Unit. Among all the groups, reduction in clinical parameters were observed at different time intervals. Intergroup comparison revealed SRP+ Chlorhexidine gel group showed maximum efficacy in reduction of PPD and RAL in the study.
Key Words: *Chlorhexidine Gel , Diode Laser ,Periodontitis, Scaling and Root Planing, Tetracycline fibers.*

Received 28.07.2022 Revised 19.08.2022 Accepted 26.10.2022

INTRODUCTION

The main causative factor which is responsible for inflammation of periodontium includes a subcategory of specific bacteria of the oral microflora[1].With the primary goal of elimination of the infection and prevention of disease progression, scaling and root planning became an integral part of periodontal therapy[2].In search of a more efficient and a traumatic technique which improves periodontal healing, local administration of drugs and use of lasers have been proposed as treatment modalities for various periodontal diseases[3].

Administration of systemic antimicrobial drugs as an adjunct to mechanical therapy have been proposed as a treatment modality[4].Although antibiotic therapy is considered as beneficial in management of recurrent periodontal diseases still it possess certain disadvantages as well such as development of resistance in strains and increased chances of superinfection.[5] In order to these complications, localized administration of drugs at target sites came into existance.[4] Various antibiotics and antimicrobial agents have been recognized as local drug delivery agents viz. Chlorhexidine, Tetracycline, Minocycline, Metronidazole etc., available in various delievery systems in the form of gels, chips, fibers etc. The concept of sustained local drug delivery was first developed by Dr. Max Goodson[5].Two Local Drug Delivery Systems were used in this study: Chlorhexidine Gel (CHLO-SITE™) and Tetracycline fibers (Periodontal Plus AB™).

Since 1900, LASERs (Light Amplification by Stimulated Emission of Radiation) exist in dental practice. Diode, CO2, Nd:YAG and ER: YAG are some commercially available Lasers with provided benefits such as reduced bleeding, less postoperative swelling, bacterial elimination, reduced chances of suturing, better healing and minimal pain after surgery[6].Literature is replete with various studies incorporating different treatment modalities individually and as for now no study has yet been proposed in which four different modalities i.e, SRP alone, chlorhexidine gel, tetracycline fibers and Diode laser has been performed altogether, especially in smokers. Thus the present study was carried out in order to compare the additive benefits of the above mentioned treatment modalities when they are used as an adjunct to SRP for treating Chronic periodontitis among smokers.

MATERIAL AND METHODS

The sample size consisted of 80 sites (age group 30-70 years) presenting with chronic periodontitis & exhibiting periodontal pockets ≥4mm, which were selected as per the following criteria & were assigned in a random manner to any of the below stated groups:

- Group A - Scaling and root planning alone (20 sites).
- Group B-Chlorhexidine Gel as an adjunct to SRP(20 sites).
- Group C - Tetracycline fibers as an adjunct to SRP (20 sites).
- Group D- Diode laser as an adjunct to SRP(20 sites).

MATERIALS

- Chlorhexidine Gel (CHLO-SITE™, GHIMAS®, Italy). (Figure 1)
- Tetracycline fibers (Periodontal Plus AB™, Advanced Biotech Products®, Chennai, India. (Figure 2)
- Diode Laser Unit (Unicorn Denmart™, Delhi, India). (Figure 3)

Figure 1.Chlorhexidine Gel

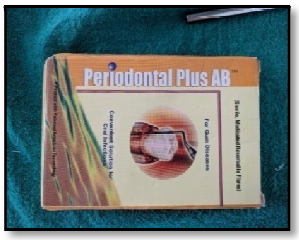


Figure 2.Tetracycline fibers

Figure 3.Diode Laser Unit

Clinical Parameters evaluated[7-9]

1. Gingival index
2. Plaque index
3. Sulcus bleeding index
4. Relative Attachment Level(RAL) (Measurement made with customized acrylic stent) (Figure8)
5. Probing Pocket depth

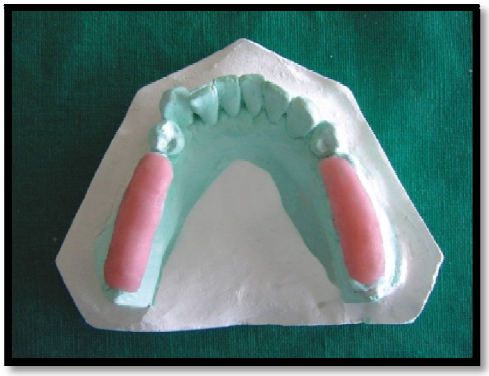


Figure 4.Customized Acrylic Stent

Patients within the age limit of 30-70 years with more than 30% of sites involved having PPD ≥ 4mm. The sample size of 80 was selected which is then assigned to the four group. At first,the selected samples underwent periodontal examination. The plaque index (PI), the gingival index (GI), Sulcus Bleeding Index (SBI), periodontal pocket depth (PPD) and Relative Attachment Level (RAL) were documented during baseline visit (prior to local drug delivery and LASER therapy), and these indices were again documented 1 month and 3months after the therapy. Oral hygiene instructions was also given.

Post-operative care

- Subjects were advised to avoid dental floss after the above mentioned procedures for 7-10 days.
- Subject were advised to maintain oral hygiene.

RESULTS AND DISCUSSION

1. Intergroup comparison of mean values of Plaque Index.

The mean Plaque Index (P.I) score difference at 3 months for Group A (SRP) with Group B (Chlorhexidine gel), Group C (Tetracycline fibers) and Group D (LASER) was 0.01±0.02, 0.01±0.02 and 0.02±0.00

respectively. Although there was no significant difference at baseline whereas a clinically significant difference was observed at 3 month interval (p<0.05) (figure 1).

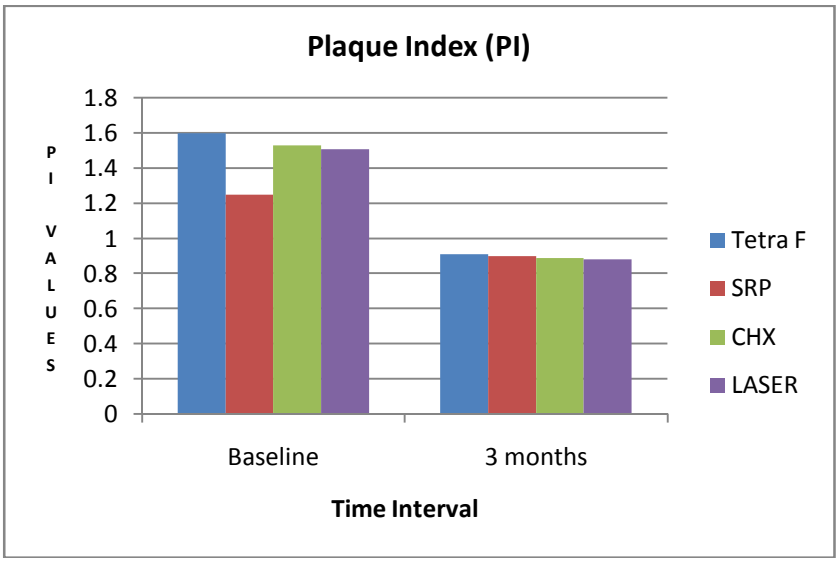
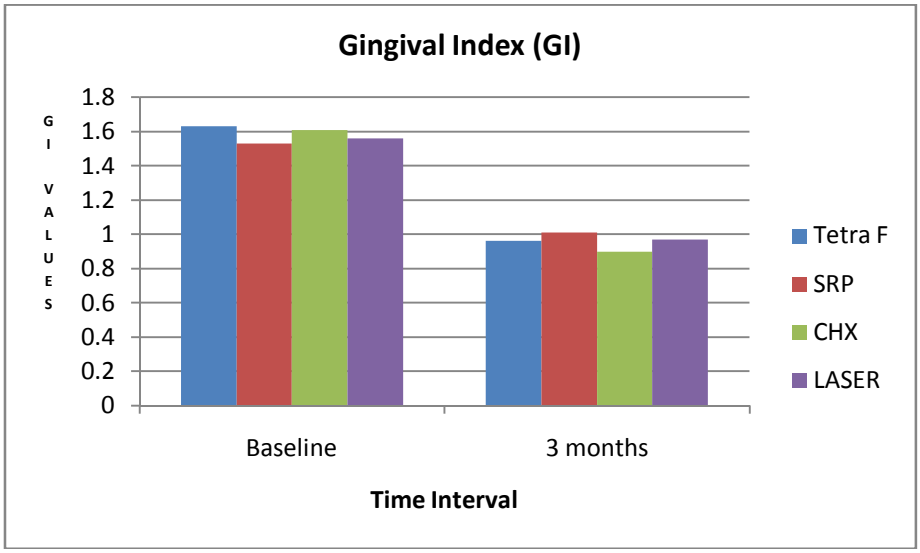


Figure 1. Intergroup comparison of Mean Plaque Index score at different time intervals

2. Intergroup Comparison of mean values of Gingival Index across all Groups.
The mean Gingival Index (G.I) score difference at 3 months for Group A (SRP) with Group B (Chlorhexidine gel), Group C (Tetracycline fibers) and Group D (LASER) was 0.11±0.07, 0.05±0.03 and 0.04±0.08 respectively. The difference quite significant at 3 month interval (p<0.05) (figure 2).



Graph 2. Intergroup comparison of Mean Gingival Index score among all groups.

3. Intergroup Comparison of mean values of Sulcus Bleeding Index across all Groups:The mean Sulcus Bleeding Index (SBI) score difference at 3 months for Group A (SRP) with Group B (Chlorhexidine gel), Group C (Tetracycline fibers) and Group D (LASER) was 0.53±0.65, 0.39±0.12 and 0.28±0.04 respectively. There was a clinically significant difference at 3 month interval (p<0.05) (Graph 3).

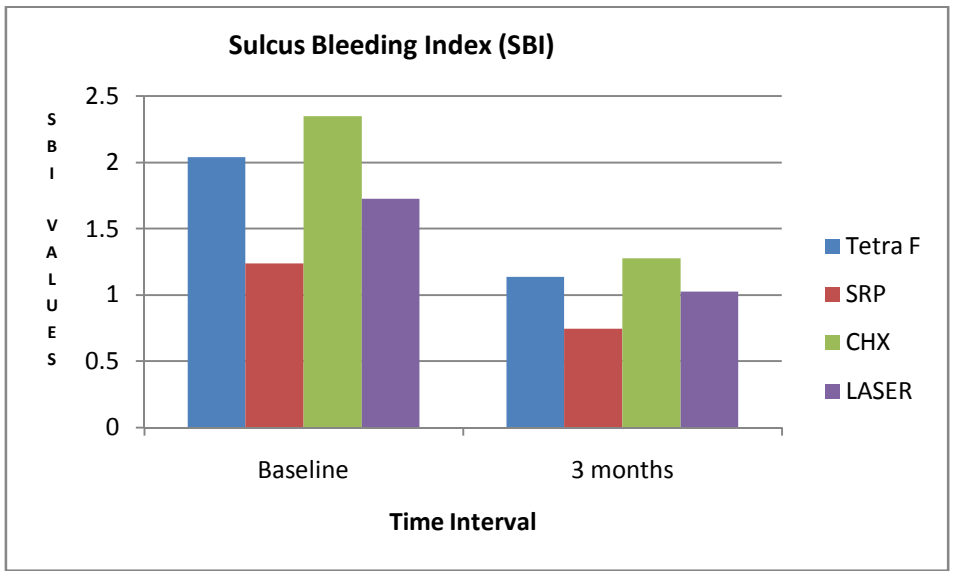


Figure 3. Intergroup comparison of Mean Sulcus Bleeding Index score among groups.

4. Intergroup Comparison of mean values of Pocket: Probing Depth across all Groups at 1month and 3 months interval.The mean Pocket Probing Depth (PPD) score difference at 1 month for Group A (SRP) with Group B (Chlorhexidine gel), Group C (Tetracycline fibers) and Group D (LASER) was 0.09±0.34, 0.29±0.31 and 0.14±0.28 respectively. The difference was a statistically significant difference between the mean Pocket Probing Depth (PPD) score at 3 month interval($p<0.05$) (figure4).

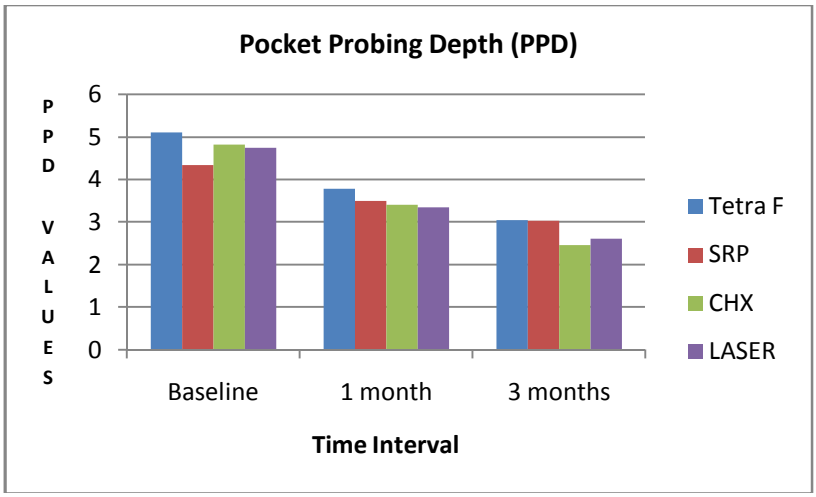


Figure 4. Intergroup comparison of Mean Pocket Probing Depth reduction (mm) among all groups.

5. Intergroup Comparison of mean values of Relative Attachment Level across all Groups at 1 and 3 months interval.

The mean Relative Attachment Level (RAL) score difference at 1 month for Group A (SRP) with Group B (Chlorhexidine gel), Group C (Tetracycline fibers) and Group D (LASER) was 0.74±0.14, 0.65±0.11 and 0.33±0.30 respectively. The mean Relative Attachment Level (RAL) score was significant at 1 month and at 3 month interval($p<0.05$) (figure 5).

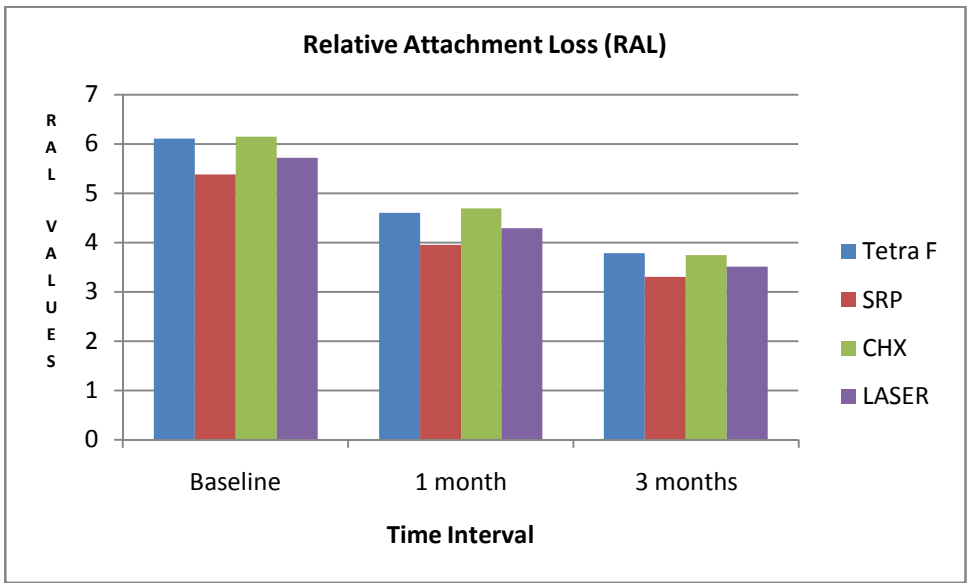


figure 5. Intergroup comparison of Mean Relative Attachment Level among all groups.

Chronic periodontitis marks deepening on the gingival sulcus as a result of detachment of tissues. The inflammatory changes induced as a result of microbe lead to degradation of collageous tissue which forms the integral part of alveolar bone as well as connective tissue[10].The purpose of periodontal therapy to eradicate the microbial factor can be accomplished via mechanical debridement using SRP[11].In order to facilitate the desired goals various adjunct are available. Use of antibiotics and lasers are some well known examples of such commercially available adjunct therapies to deal with the infectious nature of periodontal diseases.

The two modes of administration of antimicrobial agents are systemic and local. The systemic route is generally avoided as a result of the demerits associated with it, e.g., hypersensitivity reaction, toxicity related to the organs, resistant bacteria Both systemic and local routes can be used to deliver the antimicrobial agents. "Various demerits are associated with systemic antibiotic therapy such as hypersensitivity reaction, resistance development, occurrence of toxicity in organ, development of resistant bacteria as well as need of higher doses in order to attain antimicrobial concentration at targeted oral site[12].In order to overcome the above mentioned problems or complications related to Systemic routes, local route of drug administration came into evolution. In which small doses are required with reduced number of side effects[13].In order to achieve the desired goal with the antibiotic therapy, the concentration of medication in gingival crevice should be more than minimum inhibitory concentrations (MIC) of the target microbe[14].In order to target the deeper tissue and to achieve the bactericidal and decontamination effects at such sites which are difficult to attain solely by mechanical instrumentation lasers are more frequently used nowadays[15].Many studies have mentioned about the additive benefits of using Lasers like collagen synthesis, angiogenesis along with release of growth factors in order to accelerate healing[16,17].

This study was intended to assess the efficacy of Chlorhexidine gel, Tetracycline fibers and diode laser for their added benefits when used in addition to scaling and root planing. The selected patients had sites showing a pocket depth of more than 4 mm. These sites were arbitrarily distributed into four groups viz Group A, B, C and D. These groups are assigned with different treatment modalities in order to treat patients of chronic periodontitis i.e., SRP alone, SRP+ CHX , SRP +Tetracycline fibers and SRP+Laser respectively. All the groups were evaluated for the earlier mentioned clinical parameters at different time intervals: baseline, 1 month and 3 months.

Prior to the treatment, in order to record Relative Attachment Level (RAL) an acrylic stent prepared from patient's cast was required. Clark et al stated that in ored to attain reproducibility while recording the clinical parameters of the study an acrylic stent was necessary[18]. Scaling and root planing (SRP) is considered as the 'gold standard' among the non-surgical treatment modality. Haffajee *et al* observed favourable changes both at clinical as well microbiological levels are observed following mechanical debridement[19-22].In the existing study SRP was used as a treatment therapy for the control group. Despite of the effectiveness of this therapy, the eradication of etiologic factors from deeper sites of periodontal pockets and furcation areas is very challenging[23].Sbordone *et al* stated that microbial load 7 days postoperative to an episode of non surgical periodontal therapy which includes SRP alone is very

much similar to a healthy site. However, 3 week post-operatively the treated site manifested the same amount of bacterial load to as of an untreated site, it occurs due to repopulation of the treated site by the periodontal pathogens[24]. Therefore, it appears that SRP alone is not sufficient to control periodontal disease progression.

Broad spectrum activity, lesser chances of toxicity, ability to inhibit resorption of alveolar bone, anti-inflammatory actions and promotion of fibroblast attachment are some of the properties of tetracycline hydrochloride which made it popular as a local delivery system[25]

For local administration, Tetracycline was available in the form of hollow fibers that contain tetracycline. They are non-resorbable devices made of vinyl acetate, which is inert in nature biologically, containing tetracycline hydrochloride with a concentration of 25% embedded in 9 inches fibers weighing 12.7mg.(Goodson et al [26].Considering the efficacy of tetracycline, placement of the fibers at the target sites was opted for this study so that its effectiveness can be caliberated at clinical level as well.

Chlorhexidine is a bisbiguanide antiseptic. Chlorhexidine is available in three forms- the digluconate, acetate and hydrochloride salts. Chlorhexidine gluconate is a safe, recognized and more frequently used chemotherapeutic in the treatment of periodontitis, exhibiting an action against bacteria (both gram positive and gram negative), and fungi [27]. Chlosite gel is commercially available as a system which can be placed locally at the target sites. The formulation is composed of chlorhexidinedigluconate which is in concentration of 0.5% along with chlorhexidine dihydrochloride in 1% concentration[28].

LASERs work on the principle of conversion of light energy into thermal energy, so it has been used since a very long time for the manipulation of soft tissues during various periodontal procedures. Due to the additional benefits attained using Lasers, during non-surgical periodontal therapy, such as decontamination of the targetted tissue as a result of bactericidal action it has become popular over the years to use it as an adjunct to SRP. The decontamination resulted due to inactivation of bacterial toxins. Moritz et al[29] reported that using diode laser with high power can lead to significant amount of bacterial supression when compared to SRP. Numerous studies exist which also stated about the impact of using diode laser in significantly reducing the microbial load in patients with periodontal diseases[30-33]

Castro *et al* [34] suggested that no damage to the cementum can be caused by the diode laser when routinely used as an additional therapy. In this study 980nm diode laser (2.5 W) was used in pulsed mode. In this study, improvement was appreciated in all the groups when the clinical parameters at follow ups were compared with baseline values. The indices such as PI, GI, SBI stayed in an acceptable satisfactory range throughout the study duration indicating patient compliance in oral hygiene maintenance.

Mean Plaque Index Score among different groups at baseline was found to be non-significant as per statistics ($p>0.05$) whereas it turned out to be statistically significant($p<0.05$) at 3 month interval. Tetracycline fiber group presented best results followed by chlorhexidine gel group and diode laser group with minor differences. Among all the groups, Scaling and Root Planing group showed least improvement. The results obtained were similar to what was observed by Grover et al[35]. The reason behind the reduction in scores is chemical plaque control attained by the tetracycline fibers.

Mean Gingival Index Score among different groups at baseline was noted to be non-significant whereas at3 months interval it was significant($p<0.05$) in terms of statistics. Chlorhexidine gel group showed best results.

Mean Sulcus Bleeding Index Score among different groups at an interval of 3 months was significant($p<0.05$) statistically. Chlorhexidine gel group showed best results followed by tetracycline fiber group and diode laser group.

Mean Probing Pocket Depth Score among different groups at 1 month and 3 months interval was significant ($p<0.05$) statistically. Chlorhexidine gel group showed best results followed by Diode laser group and tetracycline fiber group with subtle differences in values between the two groups. Scaling and root planning group showed least improvement. Analogous comments were made by Jose *et al* [36].

Mean Relative Attachment Level Score among different groups at 1 month and 3 months interval was significant ($p<0.05$) statistically. Chlorhexidine gel group displayed best results followed by Tetracycline fiber group and Diode laser group at 1month interval. Tetracycline fiber group showed best results followed by chlorhexidine gel group and diode laser group with subtle differences in values between the two groups at 3 months interval.

On intergroup comparison, there was better progress among all the clinical parameters (PI, GI and SBI) at 3 months interval in Chlorhexidine gel group and this difference was statistically significant (<0.05). The reduction in the index scores can be credited to the bactericidal concentrations attained subsequent to the use of chlorhexidine gel at the designated sites. Moreover, it could be a result of oral prophylaxis and fair oral hygiene maintained by the patient.

On intergroup comparison, there was better improvement in clinical parameters (PPD and RAL) at 1 month and 3 months interval in Chlorhexidine group with statistically significant differences at each time interval (<0.05). This may be due to the observation that the healthy microbiota is maintained at sites undergoing SRP for a period of 7 days and the re-colonization starts after 21 days

CONCLUSION

The current study was aimed to equate the effectiveness of different non surgical treatment modalities for the management of chronic periodontitis in case of smokers. Eighty sites diagnosed with of chronic periodontitis were selected. Chlorhexidine gel group shows maximum improvement. The combined use of Chlorhexidine Gel with scaling and root planning demonstrated best efficacy that may be of additional advantage in nonsurgical periodontal treatment. This may be attributed to decline in bacterial load as a result of antimicrobial action of Chlorhexidine. Further studies with higher sample size and extended follow up shall better assess the specific benefits of adjunctive use of the above mentioned treatment modalities.

REFERENCES

1. Phogat M. (2014). Comparative evaluation of subgingivally delivered xanthan-based chlorhexidine gel and herbal extract gel in the treatment of chronic periodontitis. JISP, ;18(2):172-7.
2. Slots J. (1979). Subgingival microflora and periodontal disease. J Clin Periodontol.(;6):351-82.
3. Caruso U, Nastri L, Piccolomini R, Ercole S, Mazza C, Guida L.(2008). Use of diode laser 980 nm as adjunctive therapy in the treatment of chronic periodontitis. A randomized controlled clinical trial. New Microbiologica. ;31:513-8.
4. Sadaf N, Bhushan A, Bisht D, Bali S. (2012). Evaluation of efficacy of tetracycline fibers in conjunction with scaling and root planing in patients with chronic periodontitis.JISP. 16:392-7.
5. Goodson J M, Haffajee A, Socransky SS. (1979). Periodontal therapy by local delivery of tetracycline. J Clin Periodontol. 6:83-92.
6. Ciancio SG. (1995). Nonsurgical chemical periodontal therapy. Periodontology; 9:27-37.
7. Löe H and Silness J. (1963). Periodontal disease in pregnancy I. Prevalence and Severity, ActaOdontol. Scand. 21: 533-51.
8. Turesky S, Gilmore ND, Glickman I. (1970). Reduced plaque formation by the chloromethyl analogue of Vitamin C. J Periodontol.;41:41-3.
9. Muhlemann, H.R.; Son, S.(1971). Gingival sulcus bleeding - a leading symptom in initial gingivitis. Helvetica Odontologica Acta.15:107-13.
10. Drisko CL, Cobb CM, Killoy WJ, Michalowicz BS, Pihlstrom BL, Lowenguth RA et al. (1995). Evaluation of periodontal treatment using controlled release tetracycline fibers: clinical response. J Periodontol. 66: 692-9.
11. Srivastava R, Verma PK, TondonP,M Kumar R,Gupta KK, Srivastava A. (2009). Chlorhexidine chip and tetracycline fibers as adjunct to scaling and root planing– A clinical study Braz. J Oral Sci. 8:201-5.
12. Genco RJ. (1991). Using antimicrobial agentsto manage periodontal diseases. AmDent Assoc. 122: 30–8.
13. Kornman KS. (1993). Controlled release local delivery antimicrobials in periodontics: prospects for the future. J Periodontol. 64: 782–91.
14. Gordon JM, Walker CB. (1993). Current status of systemic antibiotic usage in destructive periodontal disease. J Periodontol. 64: 760-71.
15. Darveau RP, Tanner A, Page RC.(2000). The microbial challenge inperiodontitis. Periodontol.1997;14:12–32.
16. Silveira PC, Streck EL, PinhoRA. (2007). Evaluation of mitochondrial respiratory chain activity in wound healing by low-level laser therapy. J Photochem Photobiol B. 86:279–82.
17. Hawkins D, Abrahamse H. (2006). Effect of multiple exposures of low-level laser therapy on the cellular responses of wounded human skin fibroblasts. Photomed Laser Surg. 24:705–14.
18. Clark DC, Chin Quee T, Bergeron MJ, Chan EC, Lautar-Lemay C. (1987). Reliability of attachment level measurements using the cementoenamel junction and a plastic stent.J Periodontol.;58:115-8.
19. Lindhe J, Liljenberg B, Adielsson B. (1983). Effect of long-term tetracycline therapy on human periodontal disease. J Clin Periodontol. 10:590-601.
20. Mombelli A, Gmur R, Gobbi C, Lang NP. (1994). Actinobacillus actinomycete mcomitans in adult periodontitis (II). Characterization of isolated strains and effect of mechanical periodontal treatment. J Periodontol.;65:827–34.
21. Shiloah J, Patters MR. (1994). DNA probe analyses of the survival of selected periodontal pathogens following scaling, root planing, and intra-pocket irrigation.J Periodontol. 65:568–75.
22. Gunsolly JC, Zambon JJ, Mellott CA, Brooks CN, Kaugars CC. (1994). Maintenance therapy in young adults with severe generalized periodontitis. J Periodontol. ;65:274-79.
23. Haffajee AD, Cugini MA, Dibart S, Smith C, Kent Jr. RL. Socransky SS. The effect of SRP on the clinical and microbiological parameters of periodontal diseases. J Clin Periodontol. 1997;24:324-34.
24. Sbordone L, Ramaglia L, Gulletta E, Iacono V. Recolonization of the Subgingival Microflora After Scaling and Root Planing in Human Periodontitis. J Periodontol. 1990;61:579-84.
25. Radhika Gupta R , Chandavarkar V , Sushama R. Galgali SR , Mishra M. Chlorhexidine, A Medicine for all the Oral Diseases.Global journal of medicine and public health.2012;1:43-8.

26. Goodson JM, Holboro D, Dunn RL, Hogan P, Dunham S. (1983). Monolithic tetracycline-containing fibers for controlled delivery to periodontal pockets. JPeriodontol. 54:575-9.
27. Chadha VS, Arora K, Manjunath BC, Kalra S. (2012).Local drug delivery in periodontics: current cincepts and trends. Inernational. Journal of Advanced Research on Oral Sciences.;1:1-9.
28. Verma A, Sanghu S,Grover D, Aggarwal S, Gupta R, Pandit N. (2012). Effect of insertion of xanthan-based chlorhexidine gel in the maintenance phase following treatment of chronic periodontitis. J. Indian Soc Periodontol. 16:381-5.
29. Moritz A, Schoop U, Goharkhay K, Schauer P, Doertbudak O, Wernisch J et al. (1998). Treatment of periodontal pockets with a diode laser. Lasers Surg Med.22:302-11.
30. Pick RM, Pecaro BC, Silberman CJ. (1985). The laser gingivectomy. The use of the CO2 laser for the removal of phenytoin hyperplasia. J Periodontol. 56:492–6.
31. Kammaa JJ, Vasdekisb VGS, Romanosc GE. (2006). The Short-term Effect of Diode Laser (980 nm) Treatment on Aggressive Periodontitis. Evaluation of Clinical and Microbiological Parameters.J Oral Laser Applications. 6:111-21.
32. Lopes BMW, Theodoro LH, Melo RF, Thompson GMA, Marcantonio RAC. (2010). Clinical and Microbiologic Follow-Up Evaluations After Non-Surgical Periodontal Treatment With Erbium:YAG Laser and Scaling and Root Planing. J Periodontol;81:682-91.
33. Birang R, Yaghini J, Adibrad M, Kiany S, Mohammadi Z, Birang E. (2011). The Effects of Diode Laser (980 nm Wavelength) and Chlorhexidin Gel in the Treatment of Chronic Periodontitis. J Las Med Sci.;2:131-8.
34. Castro GL, Gallas M, Nunez IR, Borrajo JL, Varela LG. (2006). Histological evaluation of the use of diode laser as an adjunct to traditional periodontal treatment. Photomed Laser Surg.;24:64-8.
35. Grover HS, Bhardwaj A, Dadlani H, Anil Yadav A, Singh Y. (2014). Clinical evaluation of the efficacy of two commercially available controlled-release drugs-chlorhexidine gel (CHLO-SITE)™ andtetracycline fibers (periodontal plus AB)™ as an adjunct to scalingroot planning in the treatment of chronic periodontitis. European Journal of General Dentistry.3:39-45.
36. Jose KA. (2016). Management of Chronic Periodontitis Using Chlorhexidine Chip and Diode Laser-A Clinical Study. Journal of Clinical and Diagnostic Research.10: 76-80.

CITATION OF THIS ARTICLE

S Malik, A Blaggana, A Kathuria. Comparative Evaluation Of Clinical Efficacy of Subgingivally Delivered Chlorhexidine Gel, Tetracycline Fibers And Diode Laser As An Adjunct To Scaling and Root Planing With Chronic Periodontitis Among Smokers. Bull. Env.Pharmacol. Life Sci., Spl Issue [2]: 2022: 272-279