



Comparison of Scaling and Root Planing Alone and Photodynamic Therapy with Scaling and Root Planing in Treatment of Generalized Chronic Periodontitis:-A Clinical and Microbiological Study

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ABSTRACT

Background:Lasers are one of the most promising new modalities for non surgical periodontal treatment1. They can reach sites that conventional mechanical instrumentation cannot and exhibit bactericidal and detoxification effects. In adjunction with lasers Photodynamic therapy is a selective treatment modality for the local destruction of diseased cells and tissue. The selectivity of photodynamic therapy is based on the ability of photosensitizer to preferentially accumulate in diseased cells and tissues.Material and method: Subjects with Generalized Chronic Periodontitis having probing depth of 5 -7mm in atleast 2 non adjacent teeth were selected and randomly divided into control sites and study sites, which were treated by using split mouth design by only scaling and root planing and with scaling and root planing followed by photodynamic therapy using a laser source with a wavelength of 660 nm associated with a toluidine blue photosensitizer.Results:PDT group showed more reduction in sulcus bleeding index,probing depth and total microbial count,more gain in relative attachment level and no significant difference in plaque index as compared to SRP alone.

KEYWORDS : photodynamic therapy,low level diode laser,toluidine blue dye,scaling and root planning,moderate periodontitis

Introduction:

Periodontal disease is a chronic inflammatory disease characterised by inflamed gingiva,bleeding on probing,resorption of alveolar bone and attachment loss between the tooth and its surrounding alveolar bone.For the pathogenesis of most forms of human periodontitis bacteria play one of the most important etiological roles².A primary goal in the treatment of periodontitis is the removal of local factors,bacterial deposits and the arrest of disease progression(**American Academy of Periodontology 2001**) Scaling and root planing(SRP) with hand instruments provides the best results for the treatment of periodontal disease.However,several anatomic variations may limit the success of conventional scaling and root planing,such as root concavities,dental crowding and deep pockets which may hinder the access of hand instruments into the periodontal pocket. Power driven instruments such as ultrasonic or air scalers improve the efficiency and outcome of treatment but major disadvantage is production of contaminated aerosols and accessibility.Apart from the conventional mechanical non surgical and surgical treatment methods,various adjunctive antimicrobial therapeutic possibilities are available but side effects are present.

The use of lasers has been increasingly proposed for periodontal treatment in hope for more selective and atraumatic technique for periodontal treatment.

In adjunction with lasers,Photodynamic therapy,also known as photoradiation, phototherapy or photochemo-therapy, is a selective treatment modality for the local destruction of diseased cells and tissue. The selectivity of photodynamic therapy is based on the ability of photosensitizer to preferentially accumulate in diseased cells and tissues.It involves the use of photoactive dye(photosensitizer) that is activated by exposure to light of specific wavelength in the presence of oxygen. The present study is undertaken to assess the effect of photodynamic therapy as an adjunct to scaling and root planing in subjects with chronic periodontitis.The microbiological assay may prove as an additional factor to substantiate its efficacy

Materials and method:

A total of 20 subjects were selected with Generalized Chronic Periodontitis with Probing depth of 5 -7mm in atleast 2 non adjacent teeth and age 30 years and above.. The relevant data comprising of chief complaint, preliminary history, oral hygiene habits, tissue abuse habit

etc. were recorded in the special proforma.Clinical examinations were made in a dental chair, under standard conditions of light.Microbiological samples were obtained from the periodontal pockets. Selected sites were randomly divided into control sites and study sites, which were treated by using split mouth design:

GROUP 1(CONTROL SITE): 20 sites were treated by only scaling and root planing.

GROUP 2(STUDY SITES): 20 sites were treated with scaling and root planing followed by photodynamic therapy using a laser source with a wavelength of 660 nm associated with a toluidine blue photosensitizer.

Toluidine blue dye (Helbo blue)was used for the study.It is a phenothiazine compound which is sterile,selectively absorbed by the bacteria and light activated.It is simple and safe to use. The photosensitizer was applied by placing the needle at the bottom of the periodontal pocket and was continuously deposited in a coronal direction for 1 minute followed by copious irrigation with distilled water to remove excess. The wavelength specific glasses which are dark tinted glasses were worn by the operator, assistant and the patient.In sequence,the pocket was exposed to the laser light using the fibre optic hand piece in contact mode with a spot size diameter of 2 cm.The treatment was done using a low level diode laser of wavelength 660nm(deep red) and maximum power output of 200 mw and in six sites per tooth for 10 seconds totalling 1 minute of treatment per tooth.

RECORDING OF CLINICAL AND MICROBIOLOGICAL PARAMETERS

- Gingival bleeding Index (**Muhlemann and Sons,1971**)
- Probing depth measurement using University of North Carolina probe (UNC 15).
- Relative clinical attachment level
- Plaque index(**Silness and Loe**)
- Microbiological evaluation of collected plaque sample by culturing and counting CFU units.

The above parameters were recorded on:

- 0 day i.e. before the commencement of any non-surgical therapy (baseline).

- 6 weeks after scaling and root planing with photodynamic therapy(study group)and scaling and root planing alone(control group).

STATISTICAL ANALYSIS:

Post treatment changes from baseline to different time intervals in the various clinical parameters were analyzed by paired t-test (Intra-group). Intergroup comparisons of post treatment changes were analyzed by unpaired t-test,p-value is < 0.05 was considered significant difference.



Fig 1:Application of dye



Fig 2:Laser irradiation

Results and discussion:

Intragroup comparison of mean sulcus bleeding index:

Study sites: The mean sulcus bleeding index score at baseline was 2.89 which reduced to 0.21 at 6th week. The mean difference of sulcus bleeding index was 2.68 with 92.64% reduction.By using paired t-test,p-value < 0.001 therefore there was significant difference between mean bleeding index at baseline and at 6th week.

Control sites: The mean sulcus bleeding index score at baseline was 2.78 which reduced to 0.49 at 6th week.The mean difference of sulcus bleeding index was 2.29 with 82.43% reduction. P-value < 0.001 therefore there was significant difference between mean bleeding index at baseline and at 6th week.

Intragroup observations showed the reduction of sulcus bleeding index for both the control and Study group which was statistically significant.

Intergroup comparison of mean sulcus bleeding index scores

On comparison between the Study and control sites the mean sulcus bleeding index at baseline was not statistically different. The percentage reduction of sulcus bleeding index in the Study and control group between 0-6 week were 92.64% and 82.43% respectively which is statistically significant.Favourable results by 10.21% on the 6th week are seen on the study sites as compared to the control site.

Probing depth:

Study sites: The mean probing pocket depth score at baseline was 6.13 which reduced to 2.51 at 6th week with 58.98% reduction. Difference in probing pocket depth between 0-6th week was 3.62.By using paired t-test,p-value < 0.001 therefore there is significant difference between mean PD at baseline and at 6th week.

Control sites: The mean probing pocket depth score at baseline was 5.85 which reduced to 2.93 at 6th week with 50.0% reduction. Difference in the probing pocket depth between 0-6th week 2.92.By using paired t-test p-value < 0.001 therefore there is significant difference between mean PD at baseline and at 6th week.

Intragroup observations

revealed that probing pocket depth reduction for both the treatment groups is statistically significant.³

Intergroup comparison of mean probing depth :

On comparison between the Study and control sites the mean probing depth at baseline was not statistically different. There was reduction of probing depth in both the groups from baseline till 6th week. The percentage reduction of probing depth in the Study and control group between 0-6 week were 58.98% and 50.0% respectively which is statistically significant.Favourable results by 8.98% on the 6th week are seen on the Study sites as compared to the control site.

RELATIVE ATTACHMENT LEVEL:

Study sites: The mean relative attachment level score at baseline was 9.20 which reduced to 5.55 at 6th week. The mean difference in relative attachment level between 0-6th week was 3.65 with 39.67% change by using paired t-test,p-value<0.001 therefore there was significant difference between mean RAL at baseline and at 6th week.

Control sites: The mean relative attachment level score at baseline was 9.00 which reduced to 6.05 at 6th week.The mean difference in the relative attachment level between 0-6 week was 2.95 with 32.78% change by using paired t-test,p-value < 0.001 therefore there was significant difference between mean RAL at baseline and at 6th week.

Intragroup observations showed statistically significant gain in relative attachment level for both these treatment groups.

Intergroup comparison of mean relative attachment level :

On comparison between the Study and control sites the mean relative attachment level at baseline was not statistically different. There was gain of mean relative attachment level in both the groups from baseline till 6th week. The percentage gain of relative attachment level in the Study and control group between 0-6 week were 39.67% and 32.78% respectively which was statistically significant.Favourable results by 6.89% at the 6th week were seen on the Study sites as compared to the control site.Concluding that percentage gain in relative attachment level seen in both the study and control group but it is greater in the Study group.⁴

PLAQUE INDEX:

Study sites: The mean plaque index score at baseline was 2.25 which reduced to 1.00 at the 6th week. The mean difference in the plaque index between 0-6th week was 1.25 with 55.56% reduction,by using paired t-test,p-value <0.001 week.

Control sites: The mean plaque index score at baseline was 2.09 which reduced to 1.11 at the 6th week. The mean difference in the plaque index between 0-6th week was 0.98 with 46.71% reduction,P-value < 0.001 therefore there is significant difference between mean plaque index at baseline and at 6th week.

Intragroup observations showed statistically significant reduction for plaque index for both these treatment groups.⁵

Intergroup comparison of mean plaque index

On comparison between the Study and control sites the mean probing depth at baseline was not statistically different. Percentage reduction of probing depth in the Study and control group between 0-6 week were 55.56% and 46.71% respectively which is statistically insignificant.Favourable results by 8.85% seen on the Study sites as compared to the control site.Concluding that percentage reduction in plaque index seen in both the study and control group but is greater in study group.⁶

MICROBIOLOGICAL ANALYSIS:

Study sites: The total microbial count at baseline was 168×10^4 which reduced to 12.1×10^4 at 6th week with 92.14% reduction.By using paired t-test,p-value < 0.05 therefore there is significant difference between TMC at baseline and at 6th week.

Control sites: The total microbial count at 6th week was 138×10^4 which reduced to 13.1×10^4 at 6th week with 88.72% reduction.By using paired t-test,p-value < 0.05 therefore there is significant difference between TMC at baseline and at 6th week.

Intragroup observations showed statistically significant reduction for total microbial count for both these treatment groups.^{6,7}

Intergroup observations showed significant reduction for total microbial count for both these treatment groups.⁸

Summary and conclusion:

- Lethal photosensitisation may be an effective means of eliminating periodontal pathogenic bacteria from dental plaque / biofilm in the treatment of chronic periodontitis.⁹
 - The present clinical study was designed to evaluate and compare the effect of PDT as an adjunct to scaling and root planing with scaling and root planing alone in subjects with chronic periodontitis. The microbiological assay may prove as an additional factor to substantiate its efficacy.
1. Statistically significant reduction in sulcus bleeding index in the study group as compared to the control group from the baseline to 6th week.
 2. Statistically significant reduction in probing pocket depth in the study group as compared to the control group from the baseline to 6th week.
 3. Statistically significant reduction in plaque index in both groups from the baseline to 6th week.
 4. Statistically significant gain in relative clinical attachment level in the study group as compared to the control group from the baseline to 6th week.
 5. Reduction in plaque index was statistically insignificant in the study group as compared to the control group from the baseline to 6th week.
 6. Statistically significant reduction in the total microbial count in the study group as compared to the control group from the baseline to 6th week.
- From the above observations, it can be concluded that photodynamic therapy when used as an adjunct to scaling and root planing helps in the reduction of bleeding on probing, probing

pocket depth and relative clinical attachment level. It also shows a reduction in the total microbial count. But no statistically significant difference was seen with plaque index.

- Antimicrobial photodynamic chemotherapy seems to be an attractive option as a low-cost treatment approach in the field of periodontics. Because antimicrobial photodynamic therapy can be applied locally, the systemic administration of antibiotics can be avoided in the treatment of localized infections. In antimicrobial photodynamic therapy, a high concentration of the chemical agent at the locus of infection enables efficient bacterial elimination without inducing side effects on the host tissue. Our study shows that antimicrobial photodynamic therapy has a high bactericidal effect against periodontal pathogens.^{10,11}
- To elucidate the use of photodynamic therapy as an adjunct to scaling and root planing in future, a long term study carried out on a large number of subjects which would provide the most suitable combination to obtain the desired bactericidal effect in the clinical situation, the optimal time of photosensitizer application, as well as the time of light exposure required in order to achieve the desired optimal result and if multiple courses of antimicrobial photodynamic therapy may enhance treatment outcome.^{12,13}

REFERENCES

1. Socransky S.S, Haffajee A.D. The bacterial etiology of destructive periodontal disease: current concepts. *Journal of Periodontology*. 1992;63:322-331 | 2. Andersen R, Loebel N, Hammond D, Wilson M. Treatment of periodontal disease by photodisinfection compared to scaling and root planing. *J Clin Dent* 2007; 18: 34-38 | 3. Alwaeli HA, Al-Khateeb SN, Al-Sadi A. (2013) Long term clinical effect of adjunctive antimicrobial photodynamic therapy in periodontal treatment: a randomized clinical trial. *J Clin Periodontol* 2008; 35: 877-884 | 4. Braun A, Dehn C, Krause F, Jepsen S. Short-term clinical effects of adjunctive antimicrobial photodynamic therapy in periodontal treatment: a randomized controlled clinical trial. *Lasers in Medicine Science* (Online Publication 15th September 2013) | 5. de Oliveira RR, Schwartz-Filho HO, Novaes AB Jr, Taba M Jr. Antimicrobial photodynamic therapy in the non-surgical treatment of aggressive periodontitis: a preliminary randomized controlled clinical study. *Journal Periodontol* 2007; 78: 965-973. | 6. Al-Zahrani MS, Bamshous SO, Alhassani AA, Al-Sherbini MM. Short-term effects of photodynamic therapy in periodontal status and glycemic control of patients with diabetes. *J Periodontol* 2009; 80: 1568-1573 | 7. Fabiano Dalla Lana Matiello, Alan Augusto Kalfie Coelho, Odair Pimentel Martins, Rodrigo Dalla Lana Matiello. In vitro effect of photodynamic therapy on *Aggregatibacter actinomycetemcomitans* and *Streptococcus sanguis* Braz. *Dent. J.* 2011 vol.22 no.5 | 8. Lui J, Corbet EF, Jin L. Combined photodynamic and low level laser therapies as an adjunct to non surgical treatment of chronic periodontitis. *J Periodont Res* 2011;46:89-96 | 9. Giannopoulou C, Cappuyns I, Cancela J, Cionca N, Mombelli, Effect of Photodynamic Therapy, Diode Laser and Deep Scaling on Cytokine and Acute-Phase Protein Levels in Gingival Crevicular Fluid of Residual Periodontal Pockets. *J Periodontol.* 2011 Dec 19 | 10. Giannelli Marco, Formigli Lucia, Lorenzia Luca, Bani Daniele. Combined photoablative and photodynamic diode laser therapy as an adjunct to non-surgical periodontal treatment. A randomized split mouth clinical trial. *Journal of clinical periodontology*; Oct 2012, Vol.39 Issue 10, pg 962-970 | 11. Sneha r Gokhale, Ashwini M. Padhye, Sanjay Jain and Sumanth Shivaswamy. A Comparative Evaluation of the efficacy of Diode Laser as an adjunct to mechanical debridement in Periodontal Flap Surgery. *A Clinical and Microbiological Study*. *Photomedicine and laser surgery* 2012; volume 30, Number 10, Pg 598-603 | 12. Maria Do Rosario S Freire, Decastro Isabele C, Campos Paulo F, Marques Aparecida Maria C, Ferraz Edurado G, Sarmento Viviane A. Applicability of antimicrobial photodynamic therapy in dentistry. *AOSR* 2012;2(2):88-93 | 13. Maria F. Kolbe, Fernanda V. Ribiero, Vanessa H. Luchesi, Renato C. Casarin et al. Photodynamic Therapy During Supportive Periodontal care: Clinical, Microbiological, Immunoinflammatory and patient centered performance in a split mouth randomized clinical trial. *J Periodontol* August 2014 |