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COMPARATIVE CLINICAL EVALUATION OF EFFICACY OF TETRACYCLINE AS ROOT CONDITIONING AGENT IN CONJUNCTION WITH PERIODONTAL FLAP SURGERY IN THE TREATMENT OF STAGE I/II GRADE A/B PERIODONTITIS

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ABSTRACT

Introduction: Various organic and inorganic material with minute particle sizes is found which contain remnants of dental calculus, contaminated root cementum, and subgingival plaque after scaling and root planing. Various types of root biomodification agents have not only been used to remove the smear layer but also to enlarge dentinal tubules into which healing of connective tissue may be enhanced. Concentrated tetracycline solution plays a role in removing surface inorganic smear layer created on tooth surface during most dental treatment and also it may be used to expose underlying dentinal tubules.

Aim & Objective: To clinically evaluate the efficacy of tetracycline as root conditioning agent in conjunction with periodontal flap surgery in the treatment of stage I/II grade A/B periodontitis

Materials and Methods: A total of 20 systematically healthy patients diagnosed with Stage I/II Grade A/B periodontitis were randomly selected and divided into 2 groups. Group 1: 10 Patients received root conditioning agent Tetracycline as an adjunct to Periodontal flap surgery. Group 2:10 Patients were treated with periodontal flap surgery alone. Clinical parameters such as Plaque index, sulcular bleeding index, Probing pocket depth and Clinical attachment level were assessed at baseline and after 3 months of intervention.

Results: The result showed an improvement in all clinical parameters such as PI, GI, PPD and CAL in both test and control groups when measured at baseline and after 3 months. The intergroup comparison of mean changes in all parameters from baseline to 3 month reveals a significant reduction in the Group I (test group) as compared to Group II (control group).

Conclusion: It was established that root conditioning with tetracycline helped in removal of smear layer and exposure of dentinal tubules. Hence, it's application as root conditioner has a significant role in periodontal wound healing and future new attachment.

KEYWORDS: Periodontal flap surgery, Root conditioning agents, tetracycline, smear layer, root surface.

INTRODUCTION

Regeneration of supporting tissue to tooth surfaces affected by periodontitis has been an ideal step of periodontal therapy. Periodontitis affected root surfaces shows a number of changes that include hyper mineralized or demineralized surface because of presence of plaque and calculus, cross banding of collagen fibers and surface contaminated with cytotoxic and other biologically active substances. Such surfaces are not biocompatible with adjacent periodontal cells in which the proliferation may play a pivotal role for periodontal wound healing.[1] it may also cause depression in the cell growth and viability of fibroblasts thus interfering with the new attachment.

A primary goal of periodontal therapy is the re-establishment of periodontium by removing the cytotoxic and endotoxin bacterial products which may terminate the progression of the disease process. Periodontal microbiota and bacterial endotoxins contaminate root surfaces in periodontal pocket and inhibiting the migration and attachment of fibroblasts cell. To accomplish this goal, a complete removal of adhered plaque and calculus, as well as infected cementum, is necessary, although complete removal of etiological factors is infrequent. In spite of visual appearances, scaling does not successfully contribute the root surfaces free of plaque and calculus even in the locations such as furcation areas which are barely accessible to instrumention.[2]

Mechanical instrumentation leaves the root surfaces inevitable which is covered with a smear layer that obliterates the orifices of dentinal tubules that may contain microbiota, bacterial endotoxins, and residual, contaminated root cementum. This could hamper the periodontal wound healing and regeneration of connective tissue attachment. Adequate removal of plaque, calculus, and cytotoxic substances from the diseased root surface appears to be essential for periodontal regeneration. In addition, the dentin smear layer produced by most forms of root manipulation could potentially affect fibroblast adaptation during the periodontal wound healing. Smear layer may have a composition close to that of intertubular dentin, however the smear layer present in deep dentin would reflect its lesser degree of mineralization. Smear layer is more permeable to bacterial toxins. It consists of an organic and inorganic material, with a particle size less than 0.5-15μ.

An objective of periodontal treatment is the predictable regeneration of the periodontium in areas previously affected by periodontal disease. For Periodontal regeneration, it is necessary to eliminate calculus, bacterial plaque and other cytotoxic substances on or within the diseased root surface. Human root surfaces have been treated with many substances in an attempt to make the root physiologically acceptable for the regeneration of new connective tissue attachment. Conditioning of root surface by topical application of solutions has been introduced as a regenerative procedure to dissolve the smear layer produced by root instrumentation, to aid in detoxification of root surface, to expose embedded collagen fibres and helps in connective tissue attachment.[3,4] The use of demineralizing agents in periodontal therapy can be dated back to the turn of the century. For over 90 years, various types of

agents and materials have been placed on root surfaces in an attempt to modify the diseased tooth structure. Such treatment enlarges dentinal tubules into which healing connective tissue can occur.[5]

The rationale for periodontal therapy is aimed at elimination of periodontal disease, and restoration and maintenance of healthy functional state of periodontal tissue. The dental literature has clearly demonstrated that present modes of periodontal therapy are successful in achieving these goals; however, the ultimate goal of therapy is the regeneration of the attachment, which is lost during disease process.[6] Traditional surgical and non-surgical periodontal therapies aim at arresting periodontal disease by removal of plaque-"invested" tissues from disease-affected roots. However complete removal appears to be not possible with only mechanical debridement. Thus, root conditioning has been recommended as an adjunct to mechanical root surface debridement to remove smear layer and root associated endotoxins and to expose collagen fibres on the dentin surface.[7]

A number of agents have been proposed for the demineralization procedure which include EDTA, citric acid, minocycline, tetracycline, doxycycline, fibronectin phosphoric acid, lactic acid, aromatic sulphuric acid, formic acid, Cohn's factor, sodium deoxycholate, fibronectin, PDGF-BB, IGF-1 and LASERS etc. These demineralizing agents when applied on the root surfaces remove the smear layer, eliminate the cytotoxic material like endotoxins, uncover and widen the orifices of dentinal tubules and expose the dentin collagen matrix. This collagen matrix is thought to provide a substrate which supports the chemotaxis, migration and attachment of those cells involved in wound healing and formation of new connective tissue attachment.

Tetracyclines are broad-spectrum antibiotics demonstrated to be effective in the control of periodontal pathogens. Concentrated tetracycline HCl is moderately acidic (pH 1-2) and removes the surface inorganic smear layer created on the tooth during most dental treatment. It exposes underlying dentin and its tubules. It acts as a calcium chelator and its application results in root surface demineralization. Invitro study on the effects of tetracycline HCl on dentin has revealed its properties, which may be beneficial in periodontal regenerative therapy. Terranova et al (1986) stated that root surface demineralization with tetracycline HCl enhanced soft tissue attachment, increase in fibronectin, an extra cellular matrix glycoprotein binding and enhanced fibroblast attachment and growth, while suppressing epithelial cell attachment and growth.8 Furthermore, topical tetracycline HCl is adsorbed to and released from the dentin surface maintaining an antimicrobial property for at least 14 days post therapy. Therefore, in the light of the above facts, the present study was conducted to clinically evaluate the efficacy of tetracycline as root conditioning agent in conjunction with periodontal flap surgery in the treatment of stage I/II grade A/B periodontitis.

MATERIALS AND METHODOLOGY

For present study, 20 systemically healthy patients with Stage I/II Grade A/B periodontitis were selected from Out Patient Department, Department of Periodontology and Oral Implantology of National Dental College and Hospital, Derabassi, Punjab. An ethical approval for the study was obtained from the Institutional Ethical Board Committee at National Dental College & Hospital, Derabassi.

STUDY DESIGN:

A total of 20 systematically healthy patients within the age group of 25-50 years were diagnosed with Stage I/II Grade A/B periodontitis were randomly selected and divided into 2 groups.

Group 1(Test group):10 Patients received root conditioning agent Tetracycline as an adjunct to Periodontal flap surgery.

Group 2 (Control Group):10 Patients were treated with periodontal flap surgery alone.

INCLUSION CRITERIA:

1. Patient who was diagnosed with Stage I/II Grade A/B periodontitis in the age group of 25-50 years
2. Patients who were systemically healthy and were not presenting any detectable clinical signs and symptoms of any systemic diseases.
3. In each patient at least 4-6 teeth present in either maxillary or mandibular area were included in the surgery.

EXCLUSION CRITERIA:

1. There was not any radiographic evidence of vertical or angular bone loss
2. Former or current smokers
3. Patients with healing disorders
4. Any tooth with periapical disease
5. Chronic alcoholic patients
6. Pregnant or lactating mothers

METHODOLOGY

A total of 20 patients with of Stage I / II with Grade A/B Periodontitis were randomly selected & divided into two groups with 10 patients in each group.

Group 1 (Test group) – 10 Patients received root conditioning agent Tetracycline as an adjunct to Periodontal flap surgery

Group 2 (Control Group) – 10 Patients were treated with periodontal flap surgery alone.

Phase I therapy i.e scaling and root planing was done in both group 1 and group 2.

Phase 2 therapy was carried out under local anesthesia in both group 1 and group 2.

Sulcular incision was made using BP blade no. 15 and full mucoperiosteal flap was reflected using periosteal elevator. After the reflection, a thorough surgical debridement was done using Gracey curettes. The root surface was thoroughly scaled and planed. Surgical debridement was followed by normal saline irrigation.

In group 1, Patients received tetracycline as root conditioning agent after the debridement was done. Tetracycline was applied with the help of applicator tip and it was left on the root surface for 30 sec- 1 min. (Fig.1)

GROUP- 1 (PERIODONTAL FLAP SURGERY WITH TETRACYCLINE ROOT CONDITIONING)

Fig. 1 A: PRE- OPERATIVE

Fig. 1 B: ELEVATION OF FLAP

Fig. 1C: APPLICATION OF TETRACYCLINE USING APPLICATOR TIP

Fig. 1D: INTERUPTED SUTURES (FIGURE OF EIGHT)

Fig. 1E: PERIODONTAL DRESSING

Fig. 1F: POST OPERATIVE (3 MONTHS)

In group 2, Patients were only treated with periodontal flap surgery alone. (Fig.2)

GROUP- 2 (PERIODONTAL FLAP SURGERY)

Fig. 2A: PRE-OPERATIVE

Fig. 2B: ELEVATION OF FLAP

Fig. 2C: POST DEBRIDMENT

Fig. 2D: INTERUPTED SUTURES (FIGURE OF EIGHT)

Fig. 2E: POST- OPERATIVE

The flap was repositioned and secured with sutures along with placement of periodontal pack. Post-operative instructions included antibiotic (Amoxicillin 500 mg tds for 7 days) and NSAIDs (Ibuprofen 400 mg every 4 to 6 hours as needed). Patients were instructed to use Chlorhexidine gluconate 0.2% twice a day for 15 days.

Patients were asked to report after 12 weeks for suture and periodontal dressing removal.

Assessment of Clinical Parameter:
Clinical parameters included the assessment of Plaque index (PI) Silness & Loe (1964). Gingival index (GI) Loe & Silness (1963), Probing pocket depth and Clinical attachment level were recorded at baseline and after 3 months of intervention.

STATISTICAL ANALYSIS

The data for the present study was entered in the Microsoft Excel 2007 and analyzed using the SPSS statistical software 23.0 Version. The descriptive statistics included mean, standard deviation frequency and percentage. The level of the significance for the present study was fixed at 5%.
The intergroup comparison was done using the independent t test and intragroup comparison between time intervals were done using the Paired t test The Shapiro–Wilk test was used to investigate the distribution of the data and Levene's test to explore the homogeneity of the variables.

RESULTS

Table1 *Intergroup Comparison of Various Parameter Between Group I And Group II.*

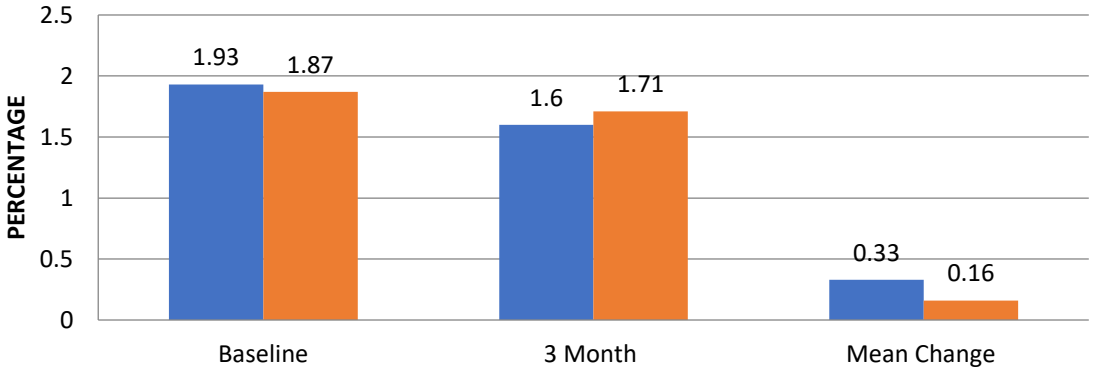
		Baseline	3 Month	Mean Change	P value
PLAQUE INDEX	**Group I**	1.93±0.33	1.60±0.29	0.33±0.06	0.001(sig)
	Group II	1.87±0.19	1.71±0.14	0.160±0.09	
GINGIVAL INDEX	**Group I**	1.68±0.28	1.39±0.29	0.290±0.07	0.001(sig)
	Group II	1.79±0.13	1.61±0.13	0.180±0.10	
PROBING POCKET DEPTH	**Group I**	6.70±1.15	4.30±0.94	2.40±0.51	0.001(sig)
	Group II	7.00±1.24	5.10±1.28	1.90±0.99	
CAL	**Group I**	7.80±0.78	5.20±0.78	2.60±0.51	0.001(sig)
	Group II	8.10±0.73	6.80±0.63	1.30±0.48	

Plaque Index score in Group 1 was 1.93±0.337 at baseline and 1.60±0.294 after 3 months reveals a reduction in the plaque index score. In Group 2 the plaque index score was 1.87±0.194 at baseline and 1.71±0.144 after 3 months. Intergroup comparison of mean PI score was found to be statistically significant between group 1 & group 2.

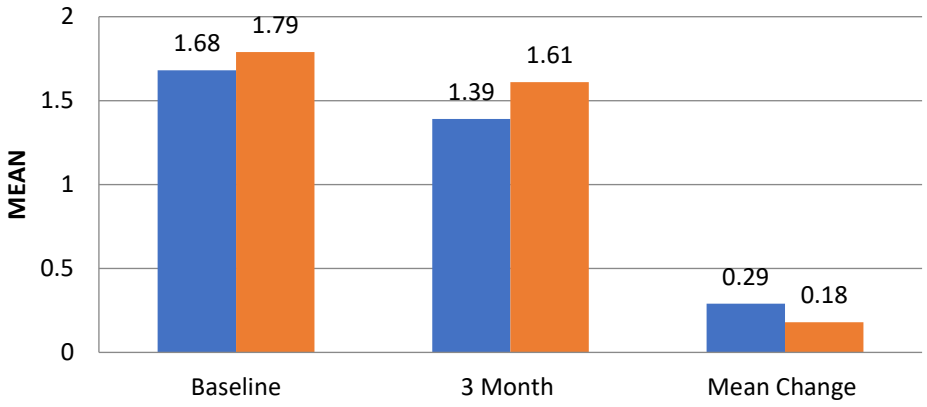
Gingival Index score in Group 1 was 1.68±0.28 at baseline and 1.39±0.29 after 3 months reveals a reduction in the gingival index score. In Group 2 the gingival index score was 1.79±0.13 at baseline and 1.61±0.13 after 3 months. Intergroup comparison of mean GI score was found to be statistically significant between group 1 & group 2.

Probing Pocket Depth mean score in Group 1 was 6.70±1.15 at baseline and 4.30±0.94 after 3 months reveals a reduction in the gingival index score. In Group 2 the probing pocket depth mean score was 7.00±1.24 at baseline and 5.10±1.28 after 3 months. Intergroup comparison of mean PPD score was found to be statistically significant between group 1 & group 2.

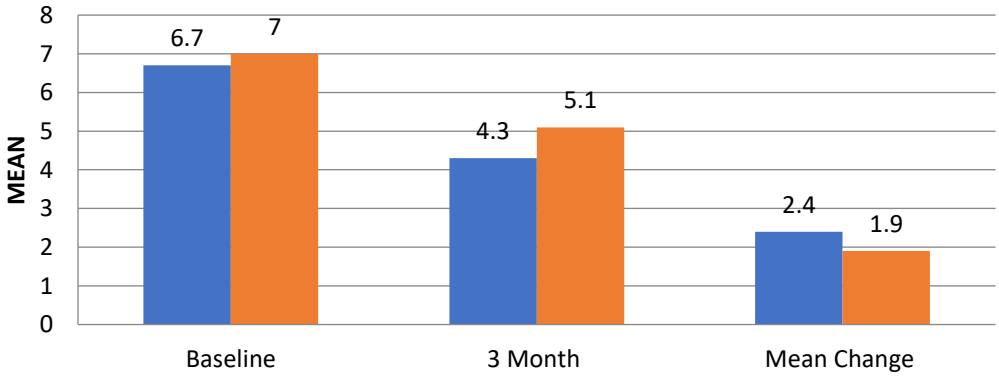
Clinical Attachment Level mean score in Group 1 was 7.80±0.78 at baseline and 5.20±0.78 after 3 months reveals a reduction in the gingival index score. In Group 2 the clinical attachment level mean score was 8.10±0.73 at baseline and 6.80±0.63 after 3 months. Intergroup comparison of mean CAL score was found to be statistically significant between group 1 & group 2.



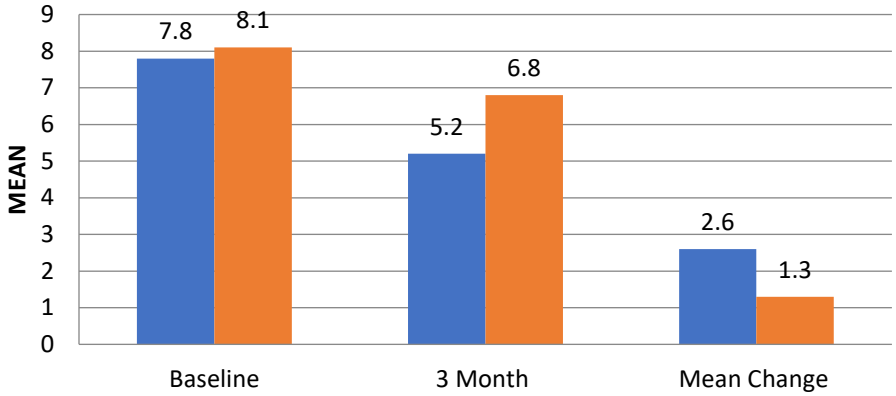
GRAPH-1 INTERGROUP COMPARISON OF PLAQUE INDEX BETWEEN GROUP I AND GROUP II



GRAPH-2 INTERGROUP COMPARISON OF GINGIVAL INDEX BETWEEN GROUP I AND GROUP II



GRAPH-3 INTERGROUP COMPARISON OF PROBING POCKET DEPTH BETWEEN GROUP I AND GROUP II



GRAPH-4 INTERGROUP COMPARISON OF CLINICAL ATTACHMENT LEVEL BETWEEN GROUP I AND GROUP II

Table2 *Intragroup Comparison of Various Parameters (From Baseline To 3 Month) In the Group I And Group II.*

		Baseline	3 Month	P value
PLAQUE INDEX	**Group I**	1.93±0.33	1.600±0.29	0.001 (Sig)
	Group II	1.87±0.19	1.710±0.14	0.001 (Sig)
GINGIVAL INDEX	**Group I**	1.68±0.28	1.390±0.29	0.001(Sig)
	Group II	1.79±0.13	1.610±0.13	0.001 (Sig)
PROBING POCKET DEPTH	**Group I**	6.70±1.15	4.30±0.94	0.001(Sig)
	Group II	7.00±1.24	5.10±1.28	0.001(Sig)
CAL	**Group I**	7.80±0.78	5.20±0.78	0.001(Sig)
	Group II	8.10±0.73	6.80±0.63	0.001(Sig)

In Group I test group), the baseline score of various clinical parameters decreased after 3 months. This reduction was statistically significant, as indicated by a p-value of 0.001. This suggests that the test group experienced a meaningful reduction in plaque accumulation, gingival index scoring, Probing pocket depth and clinical attachment loss over the 3-month period. Similarly, in **Group II** (the control group), the baseline scores reduced at 3 months. This reduction was also statistically significant, with a p-value of 0.001. This indicates that, the control group also showed a significant decrease in the values over the 3-month period.

DISCUSSION

One of the main elements that may influence periodontal regeneration is the type of roots that are exposed to the periodontal space. Inflammatory, enzymatic, and other biological variables are complicatedly linked to periodontal disease, which can result in both chemical and physical changes, especially in the root cementum. When the wound heals during periodontal therapy, the fibroblast migration, differentiation, and proliferation on the cementum may be suppressed due to the presence of bacterial cells and endotoxins on the periodontitis-affected root surface. The collagen fibre insertion into the damaged root surfaces is lost. Consequently, Ca, P, and F may be adsorbed by such surfaces and grow into a highly calcified layer[12].

In order to promote periodontal regeneration, traditional treatment of pathologically changed root surfaces depends on the mechanical removal of etiological components such calculus, plaque, root-bound toxins, and contaminated cementum. However, mechanical therapy by itself cannot fully cleanse the root surface. [13].To promote the regeneration of the lost periodontal attachment, demineralization of the root surfaces has been done during periodontal therapy. Demineralizing chemicals have been shown to reveal a change in dentin collagen, hence expanding the openings of cementum-associated proteins and dentin tubules. Additionally, it has been discovered that demineralizing chemicals can bypass the retained toxins from the modified root surface. Tetracycline is one of the drugs that have been suggested for the demineralization processes [14]. Considering the above findings, an effort has been made in this study to observe the results on the basis of various clinical parameters of diseased tooth after the application of tetracycline as an adjunct to periodontal flap surgery (Kirkland flap) as compared to periodontal flap surgery (Kirkland flap) alone.

Our results showed that on intergroup comparison, in between group 1 & group 2, there was decrease in scores of various clinical parameters like Plaque index, Gingival Index, Probing pocket depth and Clinical attachment level.

Similarly, in another study, the results demonstrated that: 1) periodontal healing following surgery led to a consistent PD reduction and CAL gain in moderate to deep periodontal pockets[15]. However, supragingival plaque and the gingival status did not show significant differences between treatment modalities, and remained almost unchanged during the observation period. After surgery, a monthly maintenance program was followed. Previous reports have indicated that frequent professional care and adequate oral hygiene are effective in limiting the frequency of sites demonstrating loss of probing attachment following surgery[16].

Similar study was conducted in literature correspondence with similar results. Sutamaya et al. 2016 conducted a study to investigate the effect of tetracycline HCL 25mg as an adjunctive therapy in surgical flap to reduce pocket depth and gingival inflammation. The results of another study also indicate that treatment of chronic periodontitis with surgical flap can result in reduced pocket depth and gingival inflammation but with adjuvant tetracycline HCL 25 mg treatment topically may provide better results compared to surgical flap only because of the use of locally antibiotic drugs can minimize bleeding, stabilize attachment level and reduce probing depth. This can lead to better control in the treatment of periodontal disease[17].

CONCLUSION

In the present study it was established that root conditioning with tetracycline helped in removal of smear layer and exposure of dentinal tubules. Hence, it's application as root conditioner has a significant role in periodontal wound healing and future new attachment. Because of more persistent effectiveness

on early root conditioning, tetracycline is preferable root conditioner agents which could be used in regenerative periodontal therapy.

REFERENCES

1. Chandra RV, Jagetia GC, Bhat KM. The Attachment of V79 and Human Periodontal Ligament Fibroblasts on Periodontally Involved Root Surfaces Following Treatment with EDTA, Citric Acid, or Tetracycline HCL: An SEM in vitro Study. J Contemp Dent Pract 2006;7(1):044-059.
2. Theodoro, Haypek, Bachmann, Garcis, Sampaio et al. Effect of Er:YAG and diode laser irradiation on the root surface: Morphological and Thermal Analysis. J Periodontol 2003; 74:838-843.
3. Wen CR, Caffesse RG, Morrison EC, Nasjleti CE, Parikh UK. In vitro effects of citric acid application techniques on dentin surfaces. J Periodontol 1992; 63:883-889.
4. Blomlöf J, Blomöf LB, Lindskog SF. Smear removal and collagen exposure after non-surgical root planing followed by etching with an EDTA gel preparation. J Periodontol 1996; 67:841-845.
5. Lafferty TA, Gher ME, Gray JL. Comparative SEM study on the effect of acid etching with tetracycline HCL or citric acid on Instrumented periodontally involved human root surfaces. J Periodontol. 1993; 64:689–93.
6. Smith BA, Smith JS, Caffesse RG, Nasjteti CE, Lopatin DE, Kowalski CJ. Effect of citric acid and various concentrations of fibronectin on healing following periodontal flap surgery in dogs. J Periodontol. 1987; 58:667–73.
7. Blomlof J, Lindskog S. Periodontal tissue-vitality after different etching modalities. J Clin Periodontol. 1995; 22:464–8.
8. Madison JS, Hokett SD. The effect of different tetracyclines on the dentin root surface of instrumented, periodontally involved human teeth: A Comparative Scanning Electron Microscope study. J Periodontol. 1997; 68:739–45.
9. Sik AG, Tarim B, Hafez AA, Yalçin FS, Onan U, Cox CF. A comparative scanning electron microscopic study on the characteristics of demineralized dentin root surface using different tetracycline HCl concentrations and application times. J Periodontol. 2000;71(2):219-25.
10. Alger FA, Solt CW, Vuddhakanok S, Miles K. The histologic evaluation of new attachment in periodontally diseased human roots treated with tetracycline hydrochloride and fibronectin. J Periodontol. 1990; 61:447-455.
11. Victor P. Terranova, Louis C. Franzetti, Susanne Hic, Roberta M. Diflorio, Raymond M. Lyall, Ulf M. E. Wikesjo, et al. A biochemical approach to periodontal regeneration: Tetracycline treatment of dentin promotes fibroblast adhesion and growth. Journal of Periodontal Research. 1986;21(4):330–337.
12. Shetty B, Dinesh A, Seshan H. Comparative effects of tetracyclines and citric acid on dentin root surface of periodontally involved human teeth: A scanning electron microscope study. J Indian Soc Periodontol. 2008;12(1):8-15.
13. Labahn, R, Fahrbach, WH, Clark, SM, Lie, T, Adams, TF. Root Dentin Morphology After Different Modes of Citric Acid and Tetracycline Hydrochloride Conditioning. J Periodontol 1992; 63:303-309.
14. Minabe, M, Takeuchi, K, Kumada, H, Umenoto, T. The effect of root conditioning with minocycline HCL in removing endotoxin from the roots of periodontally involved teeth. J Periodontol 1994; 65:387-392.
15. Scwach-Abdellaoui K, Vivien-Castioni N, Gurny R. Local delivery of antimicrobial agents for the treatment of periodontal diseases. Eur J Pharmaceut Biopharmaceut 2000;83-99

16. Trombelli L, Scabbia A, Scapoli C, Calura G. Clinical effect of tetracycline demineralization and fibrin-fibronectin sealing system application on healing response following flap debridement surgery. J Periodontol. 1996;67(7):688-93.
17. Sutamaya, Agus & Hendiani, Ina & Susanto, Agus. (2016). Clinical evaluation of adjunctive topical therapy HCl 25 mg in surgical periodontal flap. Padjadjaran Journal of Dentistry. 28. 10.24198/pjd.vol28no2.13724.