

## Clinical attachment level gain as a parameter to assess the effectiveness of root conditioning in periodontal regenerative surgical procedures

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### Abstract

**Background:** The conventional periodontal treatment aims to resolve the inflammatory lesion in the periodontal tissues, by eliminating plaque and calculus from tooth surfaces, either with scaling and root planning alone or combined with periodontal surgery. **Objective:** to appraise the clinical attachment level gain as a parameter to assess the effectiveness of root conditioning in periodontal regenerative surgical procedures. **Study design:** A case-control study. **Setting:** OPD of Periodontics, Subharti Dental College, Meerut UP. **Participants:** 20 patients. **Sampling:** Random sampling. **Statistical Analysis:** statistical analysis was done using SPSS 10 and Unpaired student "t" test. **Results:** On comparing the treatment outcomes it was observed that the gain in the clinical attachment levels was not statistically different in either of the groups i.e.  $P > 0.05$  and  $P > 0.001$ . **Conclusion:** The outcome of this study emphasizes that the clinical effect of the acid conditioning may have been overshadowed by the healing potential generated by the barrier membrane. Regenerative technique to treat a defect must be based on consideration of these factors, which will determine the predictability of a successful result.

**Keywords:** Periodontal regeneration, collagen membranes, chemical root modification, clinical attachment levels.

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### Introduction

With proper postoperative maintenance care, periodontal therapy resolves the gingival inflammation and arrests disease progression. The current objective of periodontal therapy is the regeneration of the lost attachment apparatus. Regeneration is defined as "a reproduction or reconstruction of a lost or injured part in such a way that the architecture and function of the lost or injured tissues are completely restored". This means that the attachment of the tooth regenerates when new cementum with inserting collagen fibers has formed on the detached root surface, while regeneration of the periodontal supporting apparatus also includes regrowth of the alveolar bone. Periodontal regeneration has been reported using a variety of surgical approaches involving root surface biomodification, often combined with coronally advanced flap procedures, the placement of bone grafts or bone substitute implants, or the use of organic or synthetic barrier membranes (Guided Tissue Regeneration)[1,2].

G.T.R. is based on the exclusion of gingival connective tissue cells and the prevention of the epithelial downgrowth into the wound. By excluding epithelium, cells with regenerative potential (periodontal ligament, bone cells and possible cementoblasts) can enter the wound site first and promote regeneration[3].

Clinical trials have reported that periodontal ligament cells can be induced to proliferate and migrate on biochemically conditioned dentin surfaces. This proliferation and movement have been shown to be increased when tetracycline is used to precondition the dentin surface. Also, tetracycline preconditioning of dentin removes the surface smear layer and partially demineralizes the dentin surface to expose collagen fibers[4].

Literature suggests that present regenerative techniques lead to significant amounts of regeneration at localized sites on specific teeth. However, if complete regeneration is to become a reality, additional stimuli like bone morphogenetic proteins, growth factors and enamel matrix derivatives etc. are needed to enhance the regenerative process. Research has demonstrated the usefulness of tetracycline hydrochloride (TCN-HCl) conditioning of the root surfaces with the use of membranes for G.T.R. to enhance new connective tissue attachment on the root surface[5].

Thus, the present study was designed to appraise the clinical attachment level gain as a parameter to assess the effectiveness of root conditioning in periodontal regenerative surgical procedures.

### Materials & methods

The study population consisted of twenty subjects with 10 females and 10 males aged 20-46 years, selected from the undergraduate clinic, Periodontics of the Subharti Dental College, Meerut. Each patient displayed an interproximal intrabony defect in a posterior tooth which was evident radiographically and which manually probed equal to or more than 6mm.

### Inclusion criteria

To enter the study patient was required to fulfill the following criteria:

1. Adult patients in good general health and previously diagnosed with adult periodontitis and Intrabony defect depth as assessed by standardized radiographs.
2. No antibiotic therapy within the preceding 6 months or used anti-inflammatory drugs on regular basis.
3. Adequate oral hygiene performance measured by oral hygiene index –simplified.

Written consent was obtained from each participant

### Exclusion criteria

1. Any medical condition contraindicating surgery, poor oral hygiene, Heavy Smokers.
2. Tooth mobility  $>1\text{mm}$ , Width of attached gingiva at defect site  $\leq 1\text{mm}$ , no Furcation involvement and no generalized horizontal bone resorption.

### Treatment groups and treatment modalities

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Total twenty subjects were finally enrolled in the present study. Following proper oral hygiene procedures, they were divided into two groups randomly, Group A and Group B:

- Test group (Group A) – Ten subjects having ten interproximal intrabony osseous defects to be treated with Bioresorbable, Healguide, collagen membrane with Tetracycline Hydrochloride (100mg/ml. and pH of 2 ) root conditioning.
- Control group (Group B) – Ten subjects having ten interproximal intrabony osseous defects to be treated with Healguide, collagen membrane without Tetracycline Hydrochloride root conditioning.

#### Surgical procedure[3]

The area selected for surgery was anaesthetized with 2% xylocaine containing adrenaline 1:100,000 (Astra, Sweden). Initial incision was made away from defect extending at least one tooth mesial and distal to the tooth to be treated, so that closure was not directly over the defect. A full thickness mucoperiosteal flap was reflected 2-3mm beyond the defect. Apical to the mucogingival junction, a partial thickness flap was continued by blunt dissection to free the flap from tension. Granulation tissue was removed and root planning of the tooth was done. Epithelium was removed from the inner side of the flap with a sharp curette. A template was prepared that was extending 2-3mm beyond the margins of defect in all directions and the membrane was trimmed according to this template. The flap was also trimmed where required to achieve primary tension free closure. Root conditioning was done only in test group (Group A), with freshly prepared Tetracycline Hydrochloride solution for 3 minutes followed by generous irrigation with a sterile saline solution. The G.T.R. membrane was placed in both the test group and control group and sutured to the root surface with 5-0 resorbable suture. In cases where adequate adaptation was possible due to the defect anatomy, the membrane was adapted without the use of sutures using the pouch technique an advocated by Mattson et al[6].The mucoperiosteal flap

was repositioned to cover the membrane completely. The flaps were sutured with 3-0 silk suture[7].

#### Post operative instructions

Antibiotic (Amoxicillin) 500mg three times a day and Anti inflammatory (Diclofenac Potassium) two times a day was prescribed for seven days. Chlorhexidinedigluconate 0.12% mouthrinse 10ml two times a day for four weeks was advised. At one week interval sutures were removed and subsequently follow up was done at the time interval of 1 week, 1 month, 3 months and 6 months.

#### Parameters recorded

Clinical attachment level:was measured at baseline and 3 months and 6 months postoperatively.

#### Statistical analysis

The test employed during the analysis was the student's unpaired t test.

#### Results

The observed results were as follows:Pre operatively, in Group A at baseline, clinical loss of attachment of 7-8 mm and 5-6 mm was equally distributed among 10 subjects i.e. 5 each.

Post operatively, in this group, at 3 month interval gain in clinical attachment level was 4-5 mm in five subjects and 2-3 mm in four subjects. One subject did not show any improvement in gain of clinical attachment level. The results were almost similar at 6 month post operative interval.

Mean  $\pm$  standard deviation value pre operatively for clinical attachment loss in Group A was  $6.8 \pm 1.13$ .Post operatively at 3 months and 6 months it was reduced to  $3.9 \pm 1.44$  and  $4.0 \pm 1.69$  respectively. Table.1

**Table 1: Clinical attachment level in mm pre operative at baseline and post operative at the interval of three months and six months in test group ( group A )**

S.no.	Pre operative at baseline (mm)	Post operative at three months(mm)	Post operative at six months(mm)
1	8	3	3
2	6	3	3
3	6	3	3
4	6	2	2
5	7	7	8
6	6	4	4
7	8	5	5
8	8	4	4
9	8	5	5
10	5	3	3
Mean $\pm$ Standard Deviation	$6.8 \pm 1.13$	$3.9 \pm 1.44$	$4.0 \pm 1.69$

The application of the unpaired student "t" statistics to test the significant effect of the tetracycline root conditioning along with G.T.R. membrane on group "A" patients on the clinical attachment levels at 3 month and 6 month time periods at 5% and 0.01% level of significance, reported that the effect was found to be significant i.e.  $P < 0.05$  and  $P < 0.001$  for the gain in clinical attachment levels. Table 2

**Table 2: Statistical test application on clinical attachment levels for test group (group A)**

Time	Mean $\pm$ standard deviation	T calculated	T tabulated (18,0.05)=2.10 (18,0.001)=3.92
Baseline versus three months	$2.9 \pm 0.31$	5.17	$P < 0.05^*$ $P < 0.001^*$
Baseline versus six months	$2.8 \pm 0.56$	4.5	$P < 0.05^*$ $P < 0.001^*$

\* $P < 0.05$ = significant, \* $P < 0.001$ = significant

Pre operatively, in Group B subjects, at baseline clinical loss of attachment was 4-5 mm in two subjects (20% of cases), 6-7 mm in six subjects (60% of cases) and 8mm in two subjects (20% of cases).

Post operative in this group, at 3 month interval gain in clinical attachment level was 3-5 mm in nine subjects. One subject did not show any significant gain in clinical attachment level. The results were almost similar at 6 month post operative interval. Table 3

**Table 3: Clinical attachment level in mm pre operative at baseline & post operative at the interval of three months and six months in control group ( group b )**

S.no.	Pre operative at baseline (mm)	Post operative at three months (mm)	Post operative at six months (mm)
1	7	2	2
2	5	2	2
3	8	4	4
4	7	2	2
5	8	4	4
6	4	3	3
7	6	3	3
8	7	4	4
9	7	3	3
10	6	4	3
Mean ±Standard Deviation	6.5±1.26	3.1±0.87	3.5±1.17

In Group B mean ± standard deviation of clinical attachment loss pre operatively was 6.5±1.26. Post operatively at 3 months and 6 months it was 3.1±0.87 and 3.5 ±1.17 respectively. The application of the unpaired student "t" statistics to test the significant effect of G.T.R. membrane on group "B" patients on the clinical attachment levels at 3 month and 6 month time periods at 5% and 0.01% level of significance shows the effect to be significant i.e.  $P < 0.05$  and  $P < 0.001$  for the gain in clinical attachment levels. Table 4

**Table 4: Statistical test application on clinical attachment levels for control group (group B)**

Time	Mean ± standard deviation	T calculated	T tabulated (18,0.05)=2.10 (18,0.001)=3.92
Baseline versus three months	3.4 ±0.39	7.2	$P < 0.05^*$ $P < 0.001^*$
Baseline versus six months	3.5±0.45	6	$P < 0.05^*$ $P < 0.001^*$

\*  $P < 0.05$  =significant, \*  $P < 0.001$ = significant

On comparing the treatment outcomes by applying the statistical unpaired "t" test to the gain in clinical attachment levels between the test and the control groups, it was observed that the gain in the clinical attachment levels was not statistically different in either of the groups i.e.  $P > 0.05$  and  $P > 0.001$ . Table 5

**Table 5: Statistical test application on inter group comparison of clinical attachment levels between group A and B**

Time	Mean ± standard deviation	T calculated	T tabulated (18,0.05)=2.10 (18,0.001)=3.92
Baseline versus three months	0.5±0.11	0.87	$P > 0.05^*$ $P > 0.001^*$
Baseline versus six months	0.5±0.02	0.79	$P > 0.05^*$ $P > 0.001^*$

\*  $P > 0.05$ = non significant, \*  $P > 0.001$ = non significant

### Discussion

The role of chemical root conditioning alone as well as an adjunct with different type of barrier membranes in G.T.R. has been advocated by several investigators[7]. In our study Collagen membranes have been used because collagen is the main constituent of periodontal connective tissue and is a plentiful protein in the body. Moreover, collagen membrane acts as a weak immunogen, provides a scaffold for PDL cell migration, is chemotactic for fibroblasts and can be easily manipulated and adapted.

The dentinal surface smear layer produced by different types of mechanical root manipulation affects fibroblast adaptation in periodontal wound healing. The condition of the root surface plays a vital role in shaping the result of wound healing between a mucogingival flap and a denuded root surface. Treatment of root surface with tetracycline solution dissolves the smear layer produced

by instrumentation and boosts up the binding of fibronectin to dentin, consequently stimulating fibroblast growth and attachment[7].

The test group (n = 10) received a resorbable barrier membrane with chemical root conditioning. The control group (n=10) received the same membrane without root conditioning. Clinical attachment levels were recorded prior to surgery and at 3 and 6 month intervals. The treatment results were statistically analyzed. In infrabony osseous defects, the use of bioresorbable barrier membrane (Healiguide) with and without chemical root conditioning yielded comparable clinical results. Pre treatment clinical attachment level in test group was  $6.8 \pm 1.13$  mm and had decreased to  $4.0 \pm 1.69$  mm at 6 month interval (average clinical attachment gain was 2.8 mm). In control group it was  $6.5 \pm 1.26$  mm and  $3.5 \pm 1.17$  mm pre treatment and post treatment respectively (average CAL gain was 3.5mm).

One subject in either of the groups did not show significant improvement for gain in clinical attachment levels. The actual comparison of treatment outcomes by GTR is a little difficult because of the variation in data collection methods among the published studies[9]. The regenerative clinical trials require standardization of data analysis so that valid comparison between studies can be made (This study presented data as the average of all sites encompassing the defect). Considering these factors the following observations compare the results of this study with those reported in the literature.

The inclusion of presence of at least one proximal area with a residual pocket depth equal to or greater than 6 mm and an associated intrabony defect confirmed by pretreatment radiograph compared favorably to those reported by earlier workers[10]. Some other studies[11] have demonstrated probing depth reduction, clinical attachment level gain and bone fill almost same as that obtained in the present study. These findings can be explained on the basis of the similarities in pretreatment probing depth, clinical attachment loss, and intrabony component of the osseous defects. In our study, pretreatment mean clinical attachment level of  $6.8 \pm 1.13$  and  $6.5 \pm 1.26$ , (test group and control group respectively) was almost similar to the values reported in these studies. This puts emphasis on the importance of selection of the defect site as well as the patient oral hygiene performance, smoking etc. in treatment outcomes.

Cortellini et al[12] has reported that sites which achieved less than 2 mm of attachment gains were observed to have probing depths and clinical attachment levels similar to those found in our study. Thus, if one was to compare only those sites which had comparable defect dimension prior to surgical therapy, similar treatment results would be found.

In the present study in the test group, clinical attachment level gain was 3.5 mm. These results were better in comparison to Kersten et al[8] who reported clinical attachment level gain of 0.8 mm. They had also concluded that root conditioning did not show any improvement over ePTFE membranes. The similarity in the results with other reports can be explained on the basis of that the clinical effect of the acid conditioning may have been overshadowed by the healing potential generated by the barrier membrane. The nonsignificant difference between treatment modalities can be because both the modalities draw upon similar regenerative mechanisms in the periodontium i.e. favoring a specific lines of cells, which makes a synergistic effect an unlikely result. Thus, the combined effect of the two is that of the one with the best effect. (non synergistic effect)[13]. Root conditioning with 10mg/ml. of tetracycline hydrochloride for 4 minutes resulted in smear layer removal, opening of dentinal tubules and exposure of collagen fibrils. Evidence suggests that high concentration of tetracycline in the tissues may impair the initial stages of wound healing, preventing the formation of new periodontal connective tissue attachment. It has been reported that the use of TCN-HCl to enhance new attachment formation in vivo is observed only with the use of low concentrations of the solution. Also, root surface demineralization can be increased by repeated application of demineralizing agents. Therefore, if thorough demineralization is an important factor in exposing collagen for enhanced periodontal regeneration, the use of a low TCN-HCl concentration (10-20 mg/ml.) with repeated application and a longer total application time is recommended[14].

#### Conclusion

The gain in clinical attachment levels through the use of GTR and tetracycline root conditioning in the treatment of intrabony defects may not be related only to the type of barrier device used. Other

factors can influence periodontal regeneration : depth and width of the defect and attachment level prior to treatment, thickness of the gingival flap, membrane exposure with accompanying plaque accumulation, coverage of the newly regenerated tissues, smoking habits, quality of the recall maintenance programme, periodontal history of the affected tooth, healing response of the subject and clinicians' surgical skill. Consideration of these factors will determine the predictability of a successful result.

#### References

1. Caton J, Greenstein G and Zappa U: Synthetic Bioabsorbable Barrier for Regeneration in Human Periodontal Defects. *J Periodontol* 1994; 65: 1037-1045
2. Karring T, Lindhe J, Cortellini P: Regenerative Periodontal Therapy. (Cited From: Lindhe J, Karring T and Lang NP: *Clinical Periodontology and Implant Dentistry*. 4<sup>th</sup> Ed., Blackwell, 2003, Pg. No. 651)
3. Wang HL and Cooke J: Periodontal Regeneration Techniques for Treatment of Periodontal Diseases. *Dent Clin N Am* 2005; 49: 637-659
4. Terranova V, Hic S, Franzetti L, Lyall R, Wikesjö U : A Biochemical Approach to Periodontal Regeneration. *AFSCM: Assays for Specific Cell Migration*. *J Periodontol* 1987; 58:247-257
5. Dyer BL, Caffesse RG, Nasjleti CF And Morrison EC: Guided Tissue Regeneration With Dentin Modification. *J Periodontol* 1993; 64: 1052-1060
6. Mattson JS, Lanny LM and Mansoor HJ : Treatment of Intrabony Defects With Collagen Membrane Barriers. *Case Reports*. *J Periodontol* 1995; 66:635-645
7. Baker PJ, Rotch HA, Trombelli L, Wikesjo UME: An in Vitro Screening Model to Evaluate Root Conditioning Protocols for Periodontal Regenerative Procedures. *J Periodontol* 2000; 71: 1139-1143
8. Kersten BG, Chamberlain ADH, Khorsandi S: Healing of the Intrabony Periodontal Lesion Following Root Conditioning with Citric Acid and Wound Closure Including Expanded ePTFE Membranes. *J Periodontol* 1992; 63:876-882.
9. Weltman R, Trejo PM, Morrison E, and Caffesse R: Assessment of Guided Tissue Regeneration Procedures in Intrabony Defects With Bioabsorbable and Non-Resorbable Barriers. *J Periodontol* 1997; 68:582-591
10. Chen CC, Wang HL, Smith F, Glickman J, Shyr Y, O'Neal R: Evaluation of a Collagen Membrane With and Without Bone Grafts in Treating Periodontal Intrabony Defects. *J Periodontol* 1995; 66:838-847
11. Eickholz P, Horr T, Klein F, Hassfeld S and Kim TS: Radiographic Parameters for Prognosis of Periodontal Healing of Infrabony Defects: Two Different Definitions of Defect Depth. *J Periodontol* 2004; 75: 399-407.
12. Cortellini P, Pini Prato G and Tonetti MS: Periodontal Regeneration of Human Infrabony Defects. I. Clinical Measures. *J Periodontol* 1993; 64:254-260
13. Machtei EE, Dunford RG, Norderyd OM, Zambon JJ and Genco RJ: Guided Tissue Regeneration and Anti-Infective Therapy in the Treatment of Class II Furcation Defects. *J Periodontol* 1993; 64: 968-973.
14. Nagata MJH, Basco AF, Leite CM, Luiz GN Melo, Maria LMM, Feld S: Healing of Dehiscence Defects Following Root Surface Demineralization with Tetracycline: A Histologic Study in Monkeys. *J Periodontol* 2005; 76:908-914

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