

Surgical Treatment of Periodontal Intrabony Defects with Guided Tissue Regeneration in Combination with Tetracycline Root Conditioning: A Radiographic Estimation

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ABSTRACT

Background: A better clinical outcome is anticipated when root conditioning is used in combination with GTR.

Objective: To radiographically compare the outcome of surgery of intrabony defects by guided tissue regeneration with or without tetracycline root conditioning.

Study design: A case-control study.

Setting: OPD of Periodontics, Subharti Dental College, Meerut, Uttar Pradesh, India.

Participants: 20 patients.

Sampling: Random sampling.

Statistical Analysis: Statistical analysis was done using SPSS 10 and Unpaired student "t" test.

Results: Volume of the osseous defect in the test group (Group A) was reduced from 21.23 mm³ to 130.83 mm³ post operatively at 6 months indicating good osseous fill in majority (70%) of the defects. Volume of the osseous defect in the control group (Group B) was reduced from 13.78 mm³ to 178.19 mm³ indicating good osseous fill in majority (90%) of the cases. The difference in the osseous fill was not statistically significant (P-value>0.05).

Conclusion: Regenerative technique to treat a defect must be based on consideration of these factors, which in turn will determine the predictability of a successful result.

Key words: Periodontal regeneration, Collagen membranes, Chemical root modification

HOW TO CITE THIS ARTICLE: Ruby Khan, Mohammed Haroon Khan*, Surgical treatment of periodontal intrabony defects with guided tissue regeneration in combination with tetracycline root conditioning: A radiographic estimation, J Res Med Dent Sci, 2018, 6(6): 158-164

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Received: 19/11/2018

Accepted: 09/12/2018

INTRODUCTION

Modern periodontal therapy aims to combat infection and regenerate the lost supporting structures. Infection control is obtained by proper scaling and root planning and maintenance. Conventional scaling and root planning alone cannot totally eliminate the etiological contaminants, but does produce a surface smear layer that may inhibit cell migration and attachment [1]. In the light of the above, periodontal regeneration has come to the forefront of periodontal research and practice. Research has made it clear that conventional treatment techniques are not sufficient to bring about the periodontal regeneration. Perhaps the oldest of most frequently attempted type of regeneration has involved chemical modification of root surface using different agents [2], such as tetracycline, citric acid and EDTA which selectively

modify the contaminated root surface by exposing collagen fibres and creating a hospitable substrate which favours the migration and attachment of fibroblasts [3-5]. Presently, osseous grafting and guided tissue regeneration (GTR) are the two techniques with the most reliable histological documentation of periodontal regeneration [6].

GTR describes the procedures designed to manipulate the cells that repopulate the wound healing site so as to ensure that this repopulation leads to regeneration of the periodontal tissues [7,8], thereby isolating the periradicular bone wound from the rest of the tissues (epithelial, connective and periosteal). This allows the cells from the periodontal ligament to repopulate the blood coagulum that forms between the alveolar bone and root surface. The isolation of the wound is achieved using a physical barrier like a membrane which may be resorbable or non resorbable. A better clinical outcome is anticipated when root conditioning is used in combination with GTR. This has led to the widespread use of the combination techniques.

Hence this study was conducted to radiographically compare the outcome of surgical treatment of intrabony defects using guided tissue regeneration with or without tetracycline root conditioning.

MATERIALS AND METHODS

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

Inclusion criteria

Each participant willing to participate and given written consent.

Adult patients in good general health and previously diagnosed with adult periodontitis.

Preferably 2 or 3 wall intrabony defects as assessed by standardized radiographs.

Adequate oral hygiene performance measured by oral hygiene index-simplified.

Exclusion criteria

Poor oral hygiene, medical condition contraindication to surgery, Heavy Smokers, Tooth mobility >1 mm, width of attached gingiva at defect site \leq 1 mm, Furcation involvement and Generalized horizontal bone resorption.

Pre-experimental treatment

Each patient was given initial periodontal therapy, instructions regarding proper oral hygiene, root planning and scaling. During a 1 month follow up period, additional instructions and re-enforcement of oral hygiene was provided according to individual needs.

Treatment groups and treatment modalities

After pre-experimental treatment and 1 month follow up period, patients were randomly selected into Group A and Group B.

Thus the division of study population is as follows:

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

Surgical procedure

- 2% xylocaine containing adrenaline 1:100,000 (Astra, Sweden) was used to anaesthetize selected area for surgery. 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 [9].
- Mucoperiosteal flap was reflected beyond the defect 2-3 mm. A partial thickness flap apical to the mucogingival junction was continued by blunt dissection to free the flap from tension.
- By removing granulation tissue and curettes were used to root plan the tooth. With a sharp curette epithelium was removed from the inner side of the flap.
- At the time of surgery, a template was prepared form autoclave piece of mackintosh that was extending 2-3 mm beyond the defect in all directions. The membrane was trimmed. The flap was trimmed to achieve primary tension free closure.
- Only in group A, root conditioning was done with freshly prepared Tetracycline Hydrochloride solution for 3 minutes followed by irrigation with a sterile saline solution.
- The G.T.R. membrane was adapted in both the groups and sutured to the root surface by using a 5-0 resorbable suture. The membrane was adapted without the use of sutures using the pouch technique an advocated by Mattson et al. [10].
- To cover the membrane completely, the mucoperiosteal flap was repositioned. The flaps were sutured with 3-0 silk suture [11].

Post-operative instructions

- Amoxicillin 500 mg thrice a day and Anti inflammatory (Diclofenac Potassium) BD for seven days was prescribed.
- Chlorhexidine digluconate 0.12% mouthrinse 10 ml two times per day for 28 days was advised.
- Sutures were removed at one week; follow up was done at the time interval of 1 week, 1 month, 3 months and 6 months.
- At each recall appointment, oral prophylaxis was done.

Parameters recorded

- Clinical parameters: Oral hygiene index simplified was recorded preoperatively at baseline and postoperatively at 1 month, 3 months, and 6 months (Table 1).

Table 1: Baseline pocket depth

S.No.	Pre-Operative at Baseline (Group A)	Pre-Operative At Baseline (Group B)
1	9	9

2	7	7
3	7	8
4	8	9
5	9	9
6	7	6
7	9	7
8	7	8
9	9	9
10	6	7
Mean ± Standard Deviation	7.8 ± 1.13	7.9 ± 1.1

- Radiographic parameters: Intraoral X-rays were recorded at baseline and six month period using radiovisiography technique. The distance from the cusp tip to the cement to enamel junction (CEJ) was measured and the following landmarks were identified on the radiographs (Figure 1).

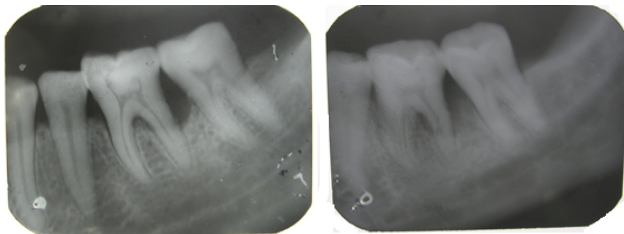


Figure 1: Preoperative and postoperative X-ray

- CEJ, if the CEJ was destroyed by restorative treatment, the apical margin of restoration was taken as a landmark.
- The most coronal point where the periodontal ligament space showed a continuous width was defined as bony defect (BD).
- The area where silhouette of the alveolar crest crossed with the root surface was termed as Alveolar crest (AC).

The calculations were done as follows [12]:

- Infra II: two lines were drawn- AUX I, in the direction of the tooth axis and Aux II, perpendicular to the tooth axis through the most coronal extension of the lateral wall of the intrabony defect. The point where AUX II crossed the contour of the root to BD resulted in Infra II.
- BDW (width of bony defect): distance from the lateral margin of the intrabony defect to the point where AUX II crossed root surface.
- Infra III: the distance from BD to AC of the lateral wall of the defect.
- Defect area: by multiplying Infra II, Infra III and BDW.

Ossous fill was calculated by subtracting the defect area at baseline and postoperatively at six months (Figure 2 and Figure 3).

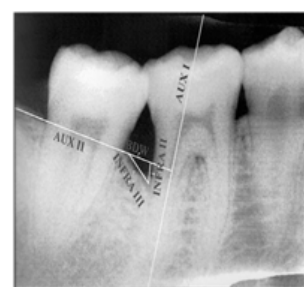


Figure 2: Calculation of Ossous fill

Statistical analysis

Data entry and statistical analysis were carried out using SPSS 10. The unpaired student “t” test was used to assess significant difference. The result was assessed using Mean ± Standard Deviation and difference was accepted significant at more than 95% (p value<0.05).

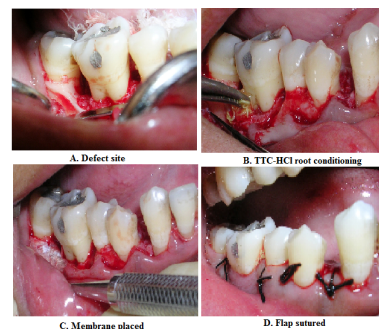


Figure 3: Difference of the distance CEJ to BD minus CEJ to AC

RESULTS

The observed results were as follows:

Disparity in data collection methods among the published studies makes it difficult to actually compare treatment outcomes by GTR. Some studies measure the deepest site of the defect while others take average of sites and still others do not specifically state the method of data collection.

It is clear that regenerative clinical trials require standardization of data analysis for 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 patient inclusion criteria in the present study was the 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 pre-treatment radiograph. The resulting date compared favourably to those reported by earlier workers.

On applying unpaired student “t” statistics to test the significant difference in oral hygiene improvement for group “A” and “B” patients’ pre-operatively and post-operatively, the effect was found significant (Table 2 and Table 3).

Volume of the osseous defect in the test group (Group A) was reduced from 21.23 mm³ to 130.83 mm³ post operatively at 6 months indicating good osseous fill in majority (70%) of the defects. Mean ± standard deviation for volume of osseous defect in this group saw the reduction from 139.89 ± 84.27 to 68.34 ± 40.24 (Table 4).

Volume of the osseous defect in the control group (Group B) was reduced from 13.78 mm³ to 178.19 mm³ indicating good osseous fill in majority (90%) of the cases (Table 5). Also, mean ± standard deviation for volume of osseous defect found the reduction to 89.97 ± 50.98.

On comparing the treatment outcomes on the osseous fill between two the groups the difference in the osseous fill was not statistically significant. i.e. P>0.05 (Table 6).

Table 2: Statistical test application on OHI-S scores for test group (group A)

Time	Mean ± SD	t calculated	Tabulated t value
			(18,0.05)=2.10 (18,0.001)=3.92
Baseline versus 1 month	0.85 ± 0.16	4.7	P<0.05* P< 0.001*
Baseline versus 3 months	1.15 ± 0	5.22	P<0.05* P<0.001*
Baseline versus 6 months	1.07 ± 0.2	2.43	P<0.05* P>0.001**

*P<0.05=significant, *P<0.001= significant, **P>0.001=non-significant

Table 3: Statistical analysis of OHI-scores for group B

Time	Mean ± SD	t calculated value	Table value
			(18,0.05)=2.10 (18,0.001)=3.92
Baseline versus 1 month	0.91 ± 0.1	5.05	p<0.05* p<0.001*
Baseline versus 3 months	1.05 ± 0.55	6.5	p<0.05* p<0.001*
Baseline versus 6 months	1.37 ± 0.05	6.2	p<0.05* p<0.001*

Table 4: Osseous fill pre-operative at baseline & post-operative at the interval of six month in group A

S.N.	Pre-operative at baseline (mm ³)	Post-operative at six months (mm ³)	Percentage fill of the osseous defect %
1	91.42	56.2	35.22%
2	54.76	21.23	61.23%
3	93.56	24.65	73.58%
4	102.9	90.77	11.78%
5	165.09	46.8	71.65%

6	261.03	130.83	49.87%
7	280.36	128.83	54.04%
8	53.76	42.02	21.83%
9	212.12	105.61	50.21%
10	83.9	54.04	29.86%
Mean ± SD	139.89 ± 84.27	68.34 ± 40.24	

Table 5: Osseous fill, pre-operative at baseline & post-operative at the interval of 6 month in group B

S.N.	Pre-operative at baseline (mm ³)	Post-operative at six months (mm ³)	Percentage of osseous fill %
1	74.49	13.78	81.50%
2	236.37	99.75	57.79%
3	384.12	156.66	59.21%
4	140.78	93.47	33.60%
5	138.79	63.17	54.48%
6	185.84	178.19	4.11%
7	111.56	26.28	76.44%
8	219.24	98.53	55.05%
9	234.93	98.26	58.17%
10	130.63	71.65	45.15%
Mean ± SD	185.67 ± 88.57	89.97 ± 50.98	

Table 6: Statistical test application on comparison of intergroup osseous fill between both groups

Time	Mean ± SD	t calculated	t tabulated (18,0.05)=2.10 (18,0.001)=3.92
baseline versus six months	26.2 ± 8.37	1.02	p>0.05* p>0.001*

DISCUSSION

G.T.R. with use of barrier membranes along with chemical modification of root surface is an accepted mode of therapy in periodontics. Clinical trials using resorbable collagen membranes have shown them to be effective in treating periodontal defects [13].

The state of root surface influences the prognosis of wound healing between a mucogingival flap and a contaminated root surface [11]. Treating the root with Tetracycline solution removes the smear layer created by instrumentation and promotes the fastening of fibronectin to dentin, thereby manipulating fibroblast development and adhesion to dentin. Moreover, using tetracycline on the roots results in reattachment and new attachment formation in humans. But literature has reported contradictory results in lieu of periodontal regeneration after use of tetracycline in humans [14].

The objective of our present study was to assess periodontal regenerative technique in intrabony defects utilizing bioresorbable membrane (Healiguide) with and

without chemical root conditioning (tetracycline hydrochloride).

In Group A, pre-treatment mean OHI-S score was 2.07 ± 0.50 and had decreased to 1.0 ± 0.3 at 6 months interval. In Group B mean OHI-S score was 2.08 ± 0.48 and 0.71 ± 0.53 pre-treatment and post treatment respectively.

The range of bone fill achieved in the test group was from 0.75 mm to 2.0 mm. A similar range was observed in control group (0.80 mm to 2.80 mm). Computation of reduction in mean volume of osseous defect for the test group yielded a linear measurement of 1.02 ± 0.36 mm and 69.51 ± 42.79 mm³ or 49.68% decrease in the intrabony defect. Control group resulted in bone regrowth of 51.54% and reduction in the defect volume was 95.70 ± 37.59 mm³.

The advancement in mean oral hygiene scores in our study are almost same as other studies which suggest the influence of a strict plaque control regimen on the treatment results [15].

Zybutz *et al.* [16] suggested that the level of post-operative oral hygiene and efficacy of supportive care programme may be the most critical for G.T.R. treatment outcomes.

Literature has demonstrated [12,17] the similarity in the decrease in bone fill area with this study. This can be accounted to the common selection parameters-probing depth, clinical attachment loss, and size of the osseous defects. Researchers [12,16] have emphasized the significance of the proper defect site and oral sanitation performed by the patients, smoking etc. in the surgical outcomes.

Kersten *et al.* [13] evaluated the effect of citric acid conditioning as an adjunct to GTR with nonresorbable ePTFE membrane in intrabony periodontal defects and found the gain in defect fill was 1.7 mm.

Recent studies [18] have reported almost similar results as has been demonstrated in the present study. This resemblance comes from the fact that the clinical outcome of the acid conditioning may have been masked by the curative effect caused by the GTR membrane.

Machtei *et al.* [19] reported that the trivial disparity among treatment therapies was based on the same regenerative mechanisms in the periodontium which favor specific lines of cells, thus making a combined effect negligible.

CONCLUSION

It can be safely recommended that several clinical factors have an important role in bringing the favourable regenerative responses to GTR. The effect of GTR has been proven to have a commendable response on the healing of the effects irrespective of the use of root conditioning methods.

ACKNOWLEDGEMENT

The authors are indebted to all their diminutive patients, who were the basis of this work and who permitted the authors to let undergo to tremendous task of completing their work successfully.

SOURCE OF FUNDING

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

CONFLICT OF INTEREST

The authors declared no conflicts of interests.

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