

Original Article

Clinical evaluation of the efficacy of a GTR membrane (HEALIGUIDE®) and demineralised bone matrix (OSSEOGRAFT®) as a space maintainer in the treatment of Miller's Class I gingival recession

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Abstract:

Background: Periodontal plastic surgical procedures aimed at coverage of exposed root surface have evolved into routine treatment modalities. The present study was designed to evaluate the effectiveness and predictability of using a collagen barrier along with a demineralized bone matrix in the treatment of recession defects in a single surgical procedure. **Materials and Methods:** Seventeen patients with Miller's class I recession were treated with a combination of a collagen barrier used along with a bone graft and coronally advanced flap technique. Clinical parameters were recorded at baseline, 3 months, 6 months, and 9 months. **Results:** The study showed a highly significant reduction in the recession depth ($70.29 \pm 21.96\%$) at the end of the study. This study showed that the use of this technique for recession coverage is highly predictable and highly esthetic root coverage can be obtained.

Key words:

Dematerialized bone matrix, gingival recession, guided tissue regeneration membrane

INTRODUCTION

The goal of treating gingival recession (GR) is to restore the gingival margin to the cemento-enamel junction (CEJ) and create normal sulcus with a functional attachment.^[1] Various periodontal plastic surgical techniques have been used for the treatment of GR including pedicle soft tissue grafts, free soft tissue grafts, and subepithelial connective tissue grafts.^[2-4] Although these procedures can produce predictable root coverage, the healing results in the formation of a long junctional epithelium (LJE) or an LJE with minor amounts of connective tissue attachment with little or no new cementum or bone created.^[5]

Tinti and Vincenzi^[6] in 1990 used the principles of guided tissue regeneration (GTR) to obtain coverage of the denuded root surface along with regeneration of the entire attachment apparatus.

At present collagen is the most commonly used GTR membrane. However, compared to conventional grafting techniques, the use of GTR for root coverage (GTRC) was found to have an inferior outcome.^[7,8] The inability of the collagen membrane to create and maintain space by itself between the root surface and the overlying

GTR membrane may be the reason for this poor predictability. Space is necessary to provide a channel for the migration of progenitor cells towards and onto the detoxified root surface, where they can differentiate into cementum and periodontal ligament cells.^[9]

Various techniques have been used to provide space beneath membranes with allografts being the most popular.^[10] Bone grafts prevent collapse of the membrane into the defect and stimulate and facilitate the proliferation of osteogenic progenitor cells.^[11] Demineralized freeze-dried bone allograft (DFDBA) has osteoinductive activity and the ability to create and maintain space, and is thus, capable of promoting regeneration of the attachment apparatus.^[12]

The aim of the present study was to clinically evaluate the long term efficacy of the combined use of a demineralised bone matrix (OSSEOGRAFT®) and a collagen barrier membrane (HEALIGUIDE®) in the treatment of Miller's class I gingival recessions.

MATERIALS AND METHODS

Study Population

The study population consisted of seventeen

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systemically healthy patients (12 males and 5 females, mean age of 37.3 years) who presented at the Department of Periodontics, Ragas Dental College, Chennai. Each patient had an isolated single Miller's Class I facial recession defect measuring ≥ 3 mm on incisors, canines, or premolar teeth. Subjects were excluded for the following reasons: poor plaque control, smokers, pregnancy, allergy to material used, endodontically treated sites, or unavailability for the 12-month follow-up. All patients were periodontally stable upon entry into the study. Patients gave oral and written consent for the treatment.

Clinical parameters

Clinical parameters were recorded prior to the surgery (baseline), at 3 months, 6 months, and 9 months postoperatively and included the following assessments.

1. Recession depth (RD) - Distance from the CEJ to the gingival margin. All measurements were made with a William's periodontal [Figure 1]
2. Recession width (RW) - Calculated at the CEJ [Figure 2].
3. Clinical attachment level (CAL) - Distance from the CEJ to the base of the sulcus
4. Probing depth (PD) - Distance from the gingival margin to the base of the sulcus
5. Width of keratinized tissue (WKT) - Distance from the gingival margin to the mucogingival junction

In addition to clinical measurements, plaque index (PI) according to Silness and Loe and bleeding on probing were recorded.

All measurements that were recorded were standardized by an acrylic stent with a groove that coincided with the center of the tooth with recession in order to obtain reproducible data during the follow-up periods. All the values were rounded off to the nearest mm.

Surgical technique

After the surgical site was anesthetized, the exposed root surfaces were thoroughly planed with a Gracy curet to detoxify the roots and deepithelialize the gingival sulcus. Following an intrasulcular incision and two oblique releasing incisions, a combined full thickness/ split thickness flap was elevated at the recession site without involving the papilla [Figure 3]. The initial incisions were located on either side of the defect at a distance from the height of the papilla equivalent to the vertical recession depth. Additional sharp dissection, as necessary, was carried out to allow for passive positioning of the flap slightly coronal to the CEJ. Following flap reflection, intra-bone marrow perforations were made on the mesial and distal portions of the root with $\frac{1}{2}$ round bur [Figure 3]. Demineralized bone graft matrix (OSSEOGRAFT™ - Advanced Biotech, India) mixed with the patient's blood was layered evenly to a thickness of 1 mm to cover the roots to the CEJ and 2 mm of the adjacent bone [Figure 4]. A collagen membrane (HEALIGUIDE® - Advanced Biotech) was trimmed such that 2–3 mm of surrounding adjacent was covered and the membrane was at the level of the CEJ [Figure 5]. The membrane was stabilized in place using firm pressure with moist gauze for 2–3 minutes. The pedicle was then coronally repositioned (tension-free) to completely cover the membrane and secured with 5-0 Mersilk (non-absorbable) sutures [Figure 6]. A periodontal pack was placed



Figure 1: Preoperative view showing the vertical dimension of the recession



Figure 2: Preoperative view showing the recession width

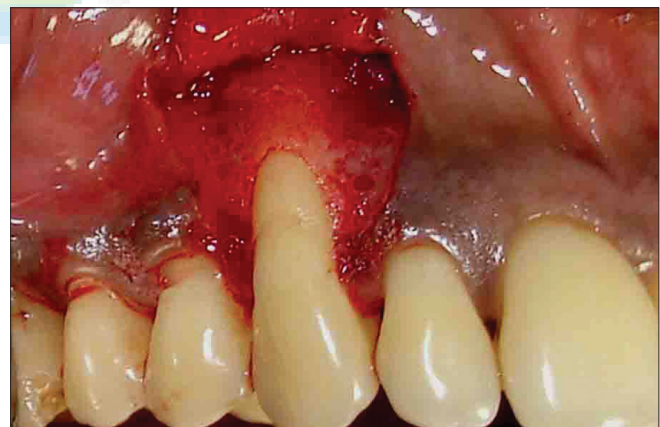


Figure 3: Operative view following raising of a full thickness flap and root surface debridement. This was followed by bone marrow penetration with the help of round bur

at the surgical site. Following surgery, routine written and oral postoperative care instructions were given to the patient. To control plaque at the surgical site, patient was instructed to apply 0.12% chlorhexidine solution with a cotton swab twice daily and to avoid toothbrushing in the area for 4 weeks. A non-steroidal anti-inflammatory analgesic was prescribed. No antibiotics were used throughout the study. Clinical parameters were evaluated at baseline, 3 months, 6 months, and 9 months post surgery [Figures 7–9].

Statistical analysis

Statistical analysis was performed using the one-way ANOVA test to evaluate the overall significance at different time intervals for recession depth (RD), recession width (RW), width of keratinized tissue (WKT), clinical attachment level (CAL), and probing depth (PD). Also, Student Newman Keuls test was used to evaluate the significance within the groups at different intervals.

In the present study, $P < 0.05$ was considered as significant at 5% level of significance.

$P < 0.001$ was considered as significant at 1% level of significance.

$$\% \text{ of root coverage} = \frac{\text{Pre op recession depth} - \text{Post op recession depth}}{\text{Pre op recession depth}} \times 100$$



Figure 4: Operative view showing placement of demineralized bone matrix



Figure 5: Operative view showing placement of collagen barrier over the bone graft



Figure 6: Flap coronally advanced and sutured



Figure 7: Postoperative view at 3 months



Figure 8: Postoperative view at 6 months

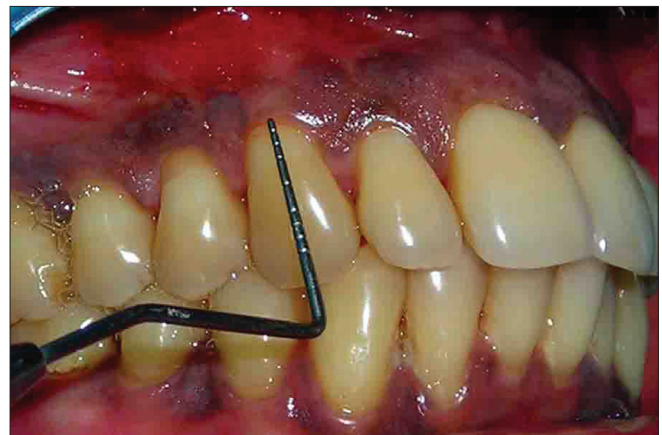


Figure 9: Postoperative view at 9 months

Table 1: Clinical parameters of the recession defects at different time intervals (in mm)

Parameters	Baseline Mean±SD	3 Months Mean±SD	6 Months Mean±SD	9 Months Mean±SD	P Value
RD	2.62±0.45 ^b	0.79±0.69 ^a	0.77±0.66 ^a	0.77±0.59 ^a	<0.001**
RW	2.88±0.42 ^b	1.44±1.44 ^a	1.44±1.44 ^a	1.35±0.98 ^a	<0.001**
WKT	1.91±0.41 ^a	3.29±0.85 ^b	3.38±0.99 ^b	3.59±1.78 ^b	<0.001**
CAL	4.09±0.44 ^b	1.65±1.32 ^a	1.47±1.67 ^a	1.53±1.78 ^a	<0.001**
PPD	1.50±0.35 ^b	1.29±0.31 ^a	1.12±0.22 ^a	1.09±0.20 ^a	<0.001**

**The overall comparisons were highly significant at 1% level ($P<0.001$), Different alphabets (a and b) denote statistical significance at 5% level ($P<0.05$)

Table 2: Recession depths and recession width in percentage at different time intervals

Parameters	3 Months Mean±SD	6 Months Mean±SD	9 Months Mean±SD
RD	69.80±24.90	70.78±24.40	70.29±21.96
RW	48.19±39.66	48.19±39.66	50.94±34.16

RESULTS

Seventeen patients with Miller class I recession defects measuring ≥ 3 mm participated in the study. All the patients completed the study and healing was uneventful. The follow-up time for this study was 9 months. Tables 1 and 2 show clinical parameters at baseline, 3 months, 6 months, and 9 months.

The results demonstrate a highly significant reduction in recession depth from a mean value of 2.62 ± 0.45 mm preoperatively to a mean value of 0.76 ± 0.59 mm postoperatively at the end of 9 months. The mean reduction in recession was 1.86 ± 0.14 mm corresponding to mean root coverage of $70.29 \pm 21.96\%$. In 6 of the 17 sites studied, 100% root coverage was obtained. Over 75% root coverage was obtained with 3 of the patients. In addition, to recession depth, recession width, clinical attachment level, and width of keratinized were significantly improved at 9 months ($P<0.05$). The recession width decreased 1.53 ± 0.56 mm (2.88 ± 0.42 mm to 1.35 ± 0.98 mm). A significant gain of 2.44 ± 0.61 mm in CAL was noted from baseline. Also, a significant increase of 1.75 ± 0.87 mm in the keratinized gingival width was noted from baseline. No statistical difference was noted in gingival index and plaque index at any time period of the follow-up. The mean probing depth of 1.50 ± 0.35 mm at baseline reduced to 1.09 ± 0.20 mm at the end of 9 months.

DISCUSSION

The ultimate goal of periodontal plastic surgical procedure utilized in the treatment of marginal tissue recession is the complete regeneration of all the supporting components of the periodontium, resulting in complete coverage of the denuded root surfaces in an esthetic and natural appearance as well as a functional manner.

Several studies have shown the effectiveness and predictability of GTR as a procedure for root coverage.^[13,14] Histologically, new bone and cementum with inserting fibers have been shown to form after recession coverage by GTR.^[15] The collagen membrane has the ability to promote platelet aggregation, be chemotactic for fibroblast and enhance wound stability,

required for proper healing. A disadvantage of collagen membranes is its lack of stiffness resulting in its collapse onto the defect. Studies have shown that space creation and maintenance are essential for periodontal regeneration.^[16] Bone replacement grafts have been advocated for maintaining space under membrane and providing osteoinductive and osteoconductive capacity.^[17,18] In our study, demineralized bone matrix was used instead of an osteoconductive material primarily due to its ability to stimulate progenitor cells to undergo differentiation to osteoblasts and form bone under the membrane.

The results of present case series have demonstrated that the use of guided tissue regeneration with bone graft results in good clinical improvement of the treated recession site and the gains can be maintained over a period of 9 months, with none of the patients exhibiting any untoward symptoms during the healing phase.

A significant reduction in recession depth (1.86 ± 0.14 mm), which corresponded to an overall percentage root coverage of $70.29 \pm 21.96\%$. These results correlate with a study done by Kimble *et al.*^[10] In 6 of the 17 sites studied, 100% root coverage was obtained. Over 75% root coverage was obtained with 3 of the patients. The comparatively lesser mean root coverage obtained in this study was a result of poor coverage in 3 of the patients. This variation in recession coverage may be dependent on the pre-operative recession depth,^[14] thickness (gingival phenotype) of the gingival,^[7] tension on the flap due to a shallow vestibule depth.^[13] In this study, no specific relationship between percentage of root coverage and the pre-existing recession width could be obtained as some patients with greater recession widths exhibited better root coverage than their counterparts with a lesser degree of recession width. None of the treated sites had membrane exposure, and thus, may have had no influence on the final root coverage.

In addition, a statistically significant reduction in probing was observed, which was not judged to be clinically significant (mean 0.41 mm). However, the results demonstrated a statistically and clinically significant gain in clinical attachment level (mean 2.44 mm). This minimal change in probing pocket depth suggests that the CAL gain could be due to some attachment to the root.

The majority of the sites showed an improvement in the width of the keratinised tissue and there was a small but significant gain in keratinised tissue (1.68 mm) from a preoperative mean value of 1.91 mm to a postoperative mean value of 3.59 mm. This small increase in keratinised gingiva may be due to the formation of the alveolar bone due to the utilization of the bone graft.

The results obtained at the end of 3 months showed an improvement in the PPD and CAL at 6 months and 9 months, could be attributed to creeping attachment as proposed by Goldman.^[19]

It is also important to emphasize that the plaque and bleeding score indicated that the patients maintained an optimal level of plaque control throughout the duration of the study.

Although histological evidence of new attachment formation could not be obtained in this study, the significant improvement in the clinical parameters studied over a period of 9 months is suggestive of regeneration of the periodontium.

The results obtained in this study could be taken as indirect evidence of new attachment formation. Since alveolar bone and periodontal ligament formation is a process that requires several months, the improvement in clinical CAL and PPD could be noticed up to the stage at which new tissue formation occurred. The significant improvement in the RD and the good root coverage obtained is evidence of the feasibility of using this procedure in the treatment of gingival recessions.

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