Soft Tissue Engineering Using Acellular Dermal Matrix Allograft For Dental Root Coverage: A Case Report

V Blaggana, A Blaggana

Citation

V Blaggana, A Blaggana. *Soft Tissue Engineering Using Acellular Dermal Matrix Allograft For Dental Root Coverage: A Case Report*. The Internet Journal of Bioengineering. 2008 Volume 4 Number 2.

Abstract

Esthetics forms an integral part of today's world. In this article we will delve into the predicament of treating the receded gingiva by soft tissue engineering using acellular dermal matrix (ADM) allograft. A young female of 37 years visited our private periodontal office with Miller's Class II gingival recession of 4mm in the mandibular left central incisor. A mucogingival surgery with ADM using a tunneling technique for root coverage was employed. The clinical parameters measured were the clinical gingival recession, the clinical attachment level and the probing depth. At 6 months postoperative assessment, 50% reduction in probing depth, 83.33% of attachment gain and 100% of clinical recession root coverage were recorded which were found to be maintained at 2 year postoperative follow-up too with the exception of probing depth which was found to be increased. In view of the encouraging results obtained in this case study, while being mindful of the potential limitations and differences, root coverage with ADM in conjunction with tunneling technique is found to be a predictable alternative to conventional procedures.

INTRODUCTION

Esthetics forms an integral part of today's world. Every individual is conscious about their semblance which is majorly governed by their smile. A smile comprises not only of the characteristics of an individual's teeth appearance and alignment but also their relation viz.-a-viz. the lips and the gingiva.

With the growing emphasis on cosmetic dentistry, various procedures have been identified which can revise the smile of a person to make them look distinguished & confident. Periodontics is one such acknowledged branch where we deal with the gingiva to give the smile an "appeal".

The prevue of periodontics spans from simpler procedures ranging from scaling and root planing to eliminate the unsightly redness of the inflamed gingiva, to technique sensitive measures including barrier membrane surgeries etc. for correcting unaesthetic gingival recessions. Recontouring the gingival margin to redefine the smile curve, depigmentation of gingiva for the elimination of hideous patchy black areas and massive debulking procedure in instances of gingival enlargements are to aver a few more of such innumerable cosmetic procedures performed by us.

In this article we will delve into the predicament of treating the receded gingiva by soft tissue engineering using acellular dermal matrix (ADM) allograft. Gingival recession as the term indicates is the apical migration of the marginal gingiva with concomitant root exposure. Besides the unaesthetic appearance, the patient often complains of sensitivity to hot or cold beverages, abrasion, difficulty in plaque control and more serious problems like root caries thus propelling them towards more specialized care [1].

The literature is replete with case studies employing a variety of root coverage procedures to efficaciously correct recession defects, viz. the coronally positioned flap, the semilunar coronally positioned flap[2], the free gingival autograft, the subepithelial connective tissue graft (SCTG)[3], guided tissue regeneration for root coverage[4], and the lateral pedicle flap. Among these techniques, the SCTG in conjunction with coronally advanced flap (CAF) has been advocated as the most predictable procedure for correction of recession defects. However, the need for a second surgical site, the morbidity linked with harvesting donor grafts, post surgical bleeding, patient discomfort, poor colour match between the donor tissue and recipient site, limited quantity of donor tissue and frequent need for multiple procedures to achieve optimal results precludes the employment of these techniques.

In order to overcome these drawbacks guided tissue regeneration utilizing the principles of barrier membrane

technique derived from synthetic or natural sources have been employed to facilitate the denuded root surface coverage. Furthermore, it may also serve to relieve functional stresses at the surgical site thus precluding the disruption of the fragile adhesions of the maturing fibrin clot to the root surface during early and the most critical phase of healing.

ADM has exhibited very creditable results among its contemporary bioresorbable membranes with most predictable root coverage results [5]. Structurally ADM (Alloderm®, BioHorizons) is an allograft, chemically processed to remove all epidermal and dermal cells while preserving the remaining bioactive dermal matrix. ADM thereby works like an autogenous graft by providing a bioactive matrix consisting of collagen, elastin, blood vessel channels and bioactive proteins which supports natural revascularization, cellular repopulation and tissue remodeling. No cases of viral transmission have been reported in more than 10 years of use with more than 900,000 grafts thus validating its safety further. The US Food and Drug Administration approved uses of ADM include not only root coverage but also as a soft tissue flap extension over bone grafts, amalgam tattoo correction and soft tissue defect repair. Harris[6] on evaluating the relative efficacy of SCTG with a partial thickness flap as opposed to ADM in conjunction with Coronally Advanced Flap (CAF) achieved a 99% of root coverage with both techniques. Compared to SCTG, ADM however offers the advantages of no donor site procurement as well as an unlimited supply, while it can bring about similar clinical outcomes, especially in multiple adjacent recession sites[4].

Mahn[5] recently proposed a tunneling technique to accommodate the use of ADM in the treatment of multiple adjacent recession defects. The tunneling approach provides better blood supply, quick healing, less scarring, and less postoperative discomfort. Santarelli et al[7] demonstrated a tunnel technique with SCTG that achieved 100% root coverage in the treatment of multiple adjacent recession defects. They also attributed this excellent result to the maximum blood supply preserved by the tunneling technique. The major disadvantages for this approach however include its technique sensitivity and the associated time required to complete the procedure.

In this study we have employed ADM with tunneling procedure to attain root coverage in case of Miller's Class II gingival recession defect [8].

CASE REPORT

A young female of 37 years visited our private periodontal office with the chief complaint of unaesthetic receding gums. Clinical examination revealed tooth 31 (FDI notation for mandibular left central incisor) with Miller's Class II gingival recession of 4 mm (distance between cementoenamel junction and gingival margin) with no interdental soft tissue loss and bone loss as evidenced radiologically. The gingival margin was inflamed and extended beyond the mucogingival junction (Fig.1). Moderate amounts of calculus deposits were evident on the teeth though the patient was regular in instituting mechanical plaque control measures. The patient was non-alcoholic, non-smoker, with no history of allergies or any other systemic debilitating disease. Routine blood and urine investigations revealed normal findings. The patient's family and medical history were found to be non-contributory. The patient received initial therapy that included scaling and root planing. Oral hygiene instructions were given and status reviewed prior to evaluation for this study. The occlusal interferences were examined and relieved. Before any surgical therapy was accomplished, an informed consent form was discussed with the patient and signed by her.

The patient was prepared for a mucogingival surgery employing ADM (Alloderm®, BioHorizons). Preoperatively, and 6 months and 2 years postoperatively the clinical parameters measured were (1) the clinical gingival recession (CR), i.e. the greatest perpendicular distance between the cementoenamel junction (CEJ) and the gingival margin; (2) clinical attachment level (CAL) recorded from the CEJ to the deepest point of the gingival sulcus; and (3) probing depth (PD) recorded from the gingival margin to the depth of the gingival sulcus.

All measurements were recorded at the mid-buccal level with a conventional William's graduated periodontal probe to the nearest 1 mm. Since there was no loss in papillary height in the interdental gingiva adjacent to the recession defect, as well as no radiographic evidence of bone loss, the defect was classified as Miller's Class II gingival recession. Based on the nature of the defects and the extent of the bone loss, complete root coverage could be expected.

After obtaining adequate anaesthesia, sulcular incisions were given around teeth 41, 31, and 32 with Bard Parker blade no. 15 (Fig.2). A partial-thickness dissection using the surgical blade was done from the depth of the gingival sulcus itself so as to raise a mucosal flap and not disturb the connective

tissue overlying the periosteum. An Orban's knife was used to continue with the partial thickness dissection in the apical direction (Fig.3) and in the papillary region between the teeth 41, 31, 32 leading to the formation of a pouch or tunnel (Fig.4). The sharp dissection was continued until enough flap tissue was mobilized to allow coronal advancement and passive placement over the initial defect. The exposed root surface was then carefully planed with curettes and treated with ethylenediamine tetra acetic acid (EDTA) for 1 minute. The ADM (Alloderm®, BioHorizons) was rehydrated in saline for at least 10 minutes prior to placement. After thorough irrigation of the defect site with saline, the ADM graft was inserted in the tunnel preparation with the help of a curette and positioned at the cementoenamel junction of tooth 31. The connective tissue side of the ADM was placed against the tooth surface, upon the recommendation of the manufacturer. The ADM was placed with the borders of the material extending 3- 4 mm apical to the margin of the defect, and 2-3 mm beyond the lateral margins of the defect over the surrounding connective tissue bed. The occlusal border of the material was placed at the level of the cementoenamel junction of the tooth (Fig.5). The material fitted smoothly, avoiding folds, overlaps & protrusions which may compromise the overlying gingival tissue. Stabilization of the material was achieved with sling sutures so as to fit snugly around the neck of the tooth and prevent epithelial migration along the tooth surface. The mucosal flap was coronally positioned over the graft and sutured with resorbable sutures (Vicryl 4-0) (Fig.6). A periodontal dressing was placed over the defect area to prevent trauma during mastication.

The patient was given amoxicillin (500 mg 3 times daily for 5 days), aceclofenac (100 mg 2 times daily for 5 days) and chlorhexidine digluconate 0.12% (2 times daily for 4 weeks). The patient was instructed not to chew in the surgical area or to brush the area for the first 4 weeks after surgery. Sutures were removed at 30 days post surgery. The patient was seen at 2 weeks, at 1 month, 6 months and 2 years for postoperative care. At all appointments, the area was professionally cleaned and oral hygiene measures were reinforced.

At 2 years postoperative, final clinical measurements were recorded.

RESULTS

At each follow-up visit, none of the patients presented with any complaints of pain while the postsurgical edema was considered within accepted norms. After a 4-week healing period, it was still possible to appreciate the dome created by the material underneath the mucosa. Mild calculus deposits however were observed at 6 months and 2 years follow-up periods with associated marginal gingival inflammation. Oral prophylaxis was performed and oral hygiene measures were reinforced at each post operative interval.

Preoperatively, the PD and CAL were measured to be 2mm and 6mm respectively while CR was determined to be 4mm when the deepest point of the gingival recession was recorded. Radiographic analysis revealed the presence of good interdental bone thus classifying the defect as Miller's Class II gingival recession.

Clinically, at the end of the first designated postoperative interval viz. 6 months (Fig.7), significant gain of 5mm in the CAL was discernable. Reduction in the PD was assessed to be 1mm with the level of marginal gingiva coinciding with the cementoenamel junction. Complete root coverage with 0mm of CR was evident. This represented 50% reduction in probing depth, 83.33% of attachment gain and 100% of clinical recession root coverage. At the subsequent follow-up time period of 2 years (Fig.8) a consistent clinical performance was observed with the same values for the various parameters recorded i.e. 5mm of gain in CAL and 4 mm of CR coverage. However, an increase in the PD was noticed from 1mm at baseline to 2mm at 2 years post-operative. This might be as a result of marginal gingival inflammation due to mild calculus deposition. In view of the fact that 2-3mm of PD is indicative of clinically normal gingiva hence no additional corrective therapy was instituted.

Figure 1

Fig. 1: Miller's Class II gingival recession: Preoperative view

Figure 2

Fig. 2: Sulcular Incision being given

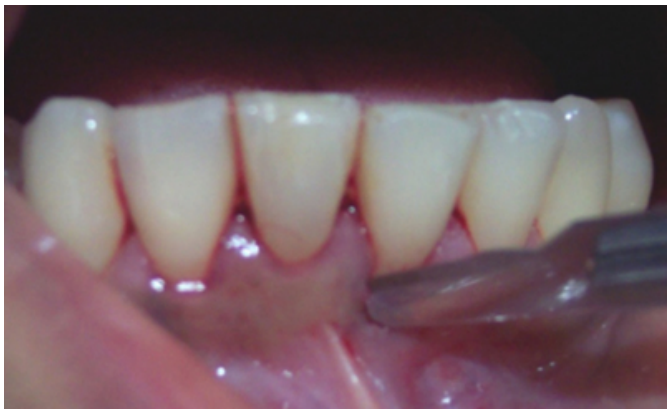

Figure 3

Fig. 3: Partial thickness dissection being done with Orban's knife

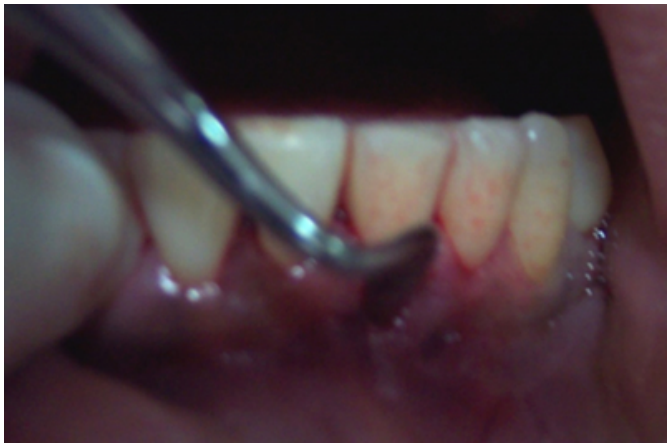

Figure 4

Fig. 4: Periodontal probe inserted to demonstrate the total release of the tunneled flap

Figure 5

Fig. 5: ADM trimmed and inserted into the tunnel preparation to cover the recession defect

Figure 6

Fig. 6: Coronal advancement of the partial thickness tunnel flap with sling sutures to secure and completely cover the membrane

Figure 7

Fig. 7: 6 months postoperative view

Figure 8

Fig. 8: 2 years postoperative view

DISCUSSION

Recognizably cosmetic dental treatment dates back more than four millennia. Throughout history, civilizations recognized that their accomplishments in the field of restorative and cosmetic dentistry were a measure of their level of competence in science, art, commerce, and trade. Esthetic dental treatment can enhance a patient's own intensely personal image of how he or she looks and how he or she would like to look. In periodontics, the refinement and delicacy of tissue manipulation makes the creation or reestablishment of an expected smile possible.

The periodontal literature is abounding with several surgical procedures that were designed to cover root surfaces exposed by buccal gingival recession. Past 20 years have seen an explosion of interest in mucogingival surgery, accompanied by clinical variations in surgical techniques to treat various mucogingival problems. Clinical trials measuring root coverage have produced results that have varied from 43% to 97%. This wide variation may be related to case selection, surgical technique, biomodification of the root, materials used and evaluation methods.

The impetus to employ a bioresorbable membrane stems from the advantages offered over non-resorbable membrane viz. avoidance of second reentry surgical procedure, alleviation of patient stress, and reduced time as well as trauma associated with membrane removal.

ADM is a bio-absorbable membrane and has properties needed for successful root coverage. It provides an acellular matrix for regeneration and healing even in a contaminated field, hence can be used in cases where the membrane is not totally covered by an overlying flap. Due to its properties, it allows revascularization and remodeling into native tissue[9].

In our case study, we used ADM for a root coverage procedure by employing a technique sensitive tunneling procedure so as to take advantage of the properties of both the material as well as the technique employed.

While analyzing the probing depth, a statistically significant reduction from baseline to 2 years postoperatively was discerned. This may be attributed to the resolution of the inflammatory component consequent to access flap surgery and the subsequent plaque control regime adopted by the patients.

We also observed a statistically significant gain in the clinical attachment level from baseline to each time interval which may be ascribed to the following:

The barrier membrane, which mechanically excludes the epithelium and gingival connective tissue cells, permitting periodontal pleuripotent cells to repopulate root surfaces thus encouraging the regeneration of new attachment apparatus.

Coronal repositioning of the flap, thereby increasing the distance for the epithelium to migrate before contacting the defect, thus providing adequate time for clot stability and organization

The coronal displacement deviates the flap margins from the most critical area of healing thus preventing the disruption of the root surface - coagulum interface.

Pini Prato et al[10] showed that the more coronal the position of the graft and flap, the more successful the outcome of a root coverage procedure.

Highlighting the major accomplishment in this case, we observed a statistically significant reduction in clinical recession at all specified time intervals which may be accredited to:

The use of bioabsorbable ADM providing an essential barrier function.

The ADM served as a matrix to integrate regenerated periodontal tissues with the surrounding periodontium.

The ADM graft has been found to increase the thickness of the marginal tissue which is thought to be the key to success for its use in root coverage procedures irrespective of the initial site characteristics, such as recession depth, narrow width of keratinized gingiva, or thin marginal soft tissue [11].

The added advantage of bioabsorbable ADM is that it does not need to be removed, thereby minimizing the trauma to the maturing tissues and consequent recession.

Apart from the advantages offered by an optimal regenerative material, the significance of good vascularity and a surgical technique accomplishing the regeneration cannot be under emphasized.

Research validates the employment of avascular ADM in conjunction with tunneling technique [5] in the light of enhanced vascularity achieved thereby promoting healing. With the partial thickness flap design, the connective tissue bed underneath the ADM and the tension free coronally displaced tunnel flap over the ADM provides superior vascularisation and augmented healing. Furthermore, the absence of releasing incisions not only decreases the possibility of unwanted graft exposure, but also maximizes the blood supply which is fundamental for regeneration to occur.

Hagighati et al[12] further credited the uniform thickness of ADM for better graft adaptation over the exposed root and the consequent superior flap adaptation over the graft material forming an important factor in the successful treatment of recessions.

In view of the encouraging results obtained in this case study, while being mindful of the potential limitations and differences, root coverage with ADM in conjunction with tunneling technique can be a predictable alternative to conventional procedures.

CONCLUSION

A simple and reproducible method for correction of gingival recession was introduced through this case study. Encouraging results and the predictability of the outcome warrants its routine use for the same. Long term clinical trials with a larger sample size are advocated for an in-depth analysis of the confirmation of these conclusions.

References

1. Tugnait A, Clerehugh V. Gingival recession—Its significance and management. J Dent 2001;29:381–394.
2. Tarnow DP. Semilunar coronally repositioned flap. J Clin Periodontol 1986;13:182–185.
3. Tal H, Moses O, Zohar R, Meir H, Nemcovsky C. Root coverage of advanced gingival recession: A comparative study between acellular dermal matrix allograft and subepithelial connective tissue grafts. J Periodontol 2002;73:1405–1411.
4. Tinti C, Vincenzi G, Cortellini P, Pini Prato GP, Clauser C. Guided tissue regeneration in the treatment of human facial recession. A twelve case report. J Periodontol 1992;63:554–560.
5. Mahn DH. Esthetic correction of gingival recession using a modified tunnel technique and an acellular dermal connective tissue allograft. J Esthet Restor Dent 2002;14:18–23
6. Harris RJ. A comparative study of root coverage obtained with an acellular dermal matrix versus a connective tissue graft: Results of 107 recession defects in 50 consecutively treated patients. Int J Periodontics Restorative Dent 2000;20:51–59
7. Santarelli GA, Ciancaglini R, Campanari F, Dinoi C, Ferraris S. Connective tissue grafting employing the tunnel technique: A case report of complete root coverage in the anterior maxilla. Int J Periodontics Restorative Dent 2001;21:77–83.
8. Miller PD. A classification of marginal tissue recession. Int J Periodontics Restorative Dent 1985;5:8–13.
9. Cummings LC, Kaldahl WB, Allen EP. Histologic evaluation of autogenous connective tissue and acellular dermal matrix grafts in humans. J Periodontol 2005;76:178–186.
10. Pini Prato G, Pagliaro U, Baldi C, et al. Coronally advanced flap procedure for root coverage. Flap with tension versus flap without tension: A Randomized controlled clinical study. J Periodontol 2000;71:188–201.
11. Woodyard JG, Greenwell H, Hill M, et al. The clinical effect of acellular dermal matrix on gingival thickness and root coverage compared to coronally positioned flap alone. J Periodontol 2004;75:44-56.
12. Haghighati F, Mousavi M, Moslemi N et al A comparative study of two root-coverage techniques with regard to interdental papilla dimension as a prognostic factor. Int J Periodontics Restorative Dent 2009;29:179–189.

Author Information

Vikram Blaggana, B.D.S., M.D.S.
Associate Professor, Department Of Periodontology, PDM Dental College and Research Institute

Anshu Blaggana, B.D.S., M.D.S.
Reader, Department Of Periodontology, PDM Dental College and Research Institute