Original Article

Comparative Clinical Evaluation of Subepithelial Connective Tissue Graft and Acellular Dermal Matrix Allograft for the Treatment of Gingival Recession

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Abstract:

Statement of Problem: Various surgical procedures have been used to achieve root coverage and subepithelial connective tissue graft (SCTG) is identified as one of the most successful techniques. Recently, acellular dermal matrix allograft (ADMA) has been developed as a substitute for SCTG to avoid removing the palatal connective tissue.

Purpose: The present study compared the clinical efficiency of ADMA and SCTG in the treatment of recession defects.

Materials and Methods: This randomized controlled clinical study, consisted of nine patients with 32 Miller's class I or II recession defects of ≥ 2 mm on the facial aspects of premolar teeth. Bleeding on Probing Index (BPI), Plaque Index (PI), Probing Depth (PD), Recession Depth (RD), Recession Width and Clinical Attachment Level (CAL) were measured at baseline and 6, 12 and 24 weeks post-surgery. Before operation, the samples were randomly allocated to ADMA (test) or SCTG (control) groups.

Results: A statistically significant improvement was observed in RD, RW and CAL, but not in BPI, PI and PD. The mean values of changes in all clinical parameters from baseline to 24 weeks postsurgery were not significantly different between the two groups. There was no significant difference in the amount of mean root coverage between the ADMA (85.42%) and SCTG (69.05%) groups (P= 0.058).

Conclusion: ADMA may be a useful substitute for SCTG in the treatment of shallow to moderate gingival recessions, if the financial aspect is not an issue for the patient.

Key Words: Subepithelial connective tissue graft; Acellular dermal matrix allograft; Gingival recession; Root coverage

Journal of Dentistry, Tehran University of Medical Sciences, Tehran, Iran (2006; Vol: 3, No.4)

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Received: 3 January 2006
Accepted: 10 May 2006

INTRODUCTION

Gingival recession is defined as partial denudation of the root surface due to apical migration of the gingival margin. [1]. It has been shown that more than 50% of people have one or more sites with gingival recession of 1 mm or more [2]. However, a deep recession (5 mm) appears to be an uncommon finding, affecting less than 1% of the buccal tooth surfaces in the general population [3].

While several mucogingival procedures have been proven successful, the most common is considered to be the pedicle graft technique with or without addition of free connective tissue. Non-submerged grafts (free gingival grafts) are no longer justified in the coverage of recession defects for aesthetic purposes. In other words, the success rate and color match

with the surrounding tissues are unpredictable [4]. The subepithelial connective tissue graft (SCTG) technique, introduced in 1980 by Langer and Langer [5], enhanced the predicttability of covering localized areas of root exposure. This technique combines the advantages of both free gingival and pedicle grafts.

The high survival potential of SCTGs is due to the double source of blood supply, provided by the gingival flap on the facial aspect and the tissue peripheral to the exposed root surface [6]. Another advantage of this technique compared to free gingival grafts is its better color match with adjacent tissues. However a disadvantage of the procedure is the morbidity associated with the second surgical site needed to harvest the autogenous palatal donor tissue [7]. This causes discomfort to the patient, because of post-surgical pain and the risk of bleeding from the donor area [8]. According to previous studies, it has become evident that patients with thin and friable gingival tissue often also present with thin palatal mucosa. Consequently, these individuals not only are subject to developing recession, but also may not be good candidates for obtaining a proper thickness of connective tissue for plastic periodontal surgery [9].

When using the guided tissue regeneration (GTR) procedure, application of barrier membranes underneath coronally sliding flaps has been suggested to avoid the need for tissue harvesting from the palate. However, although the degree of root coverage yielded by GTR is similar to SCTG, the former procedure produces a lower increase in gingival thickness [10]. Therefore, it should be noted that gingival phenotype (thick phenotype) plays an important role in preventing the recurrence of tissue recession [11] and an increase in gingival thickness represents a desirable clinical outcome. Furthermore, the ability of GTR to produce a stable long-term result has been questioned [12].

Recently, acellular dermal matrix allograft (ADMA) was introduced as a substitute for autogenous connective tissue grafts. ADMA is a special human donor skin preparation from which the cell component (the target of rejection response) is removed. A major advantage of ADMA over skin grafts is the absence of the undesirable dead cells with their associated class I and II Human Leukocyte Antigen (HLA) antigens and potential transmission of cell-associated viruses [13]. Moreover, the ultra-structural integrity of the acellular matrix is maintained, thus avoiding an induction of an inflammatory response. The remaining bioactive components and the extra-cellular matrix are subsequently freeze-dried [14]. Clinical and in-vitro studies suggest that ADMA is a non-immunogenic scaffold that allows the host tissue to grow within it and heals by repopulation and revascularization, rather than through a granulation process maturing to scar [13]. Due to its non-vital structure, it depends on cells and blood vessels from recipient site to achieve reorganization [15].

Donor tissue undergoes several levels of testing and screening to assure its safety. Blood samples from each skin donor for Allo-Derm are screened by a certified laboratory and found to be negative when tested for HB_S Ag, HIV types 1 and 2, HCV and syphilis (PRP or VDRL). These tests are all FDA licensed [14]. ADMA has been used in medical settings for several years with a particular impact in treatment of burn victims, plastic surgery, neurosurgery, ophthalmology, and otolaryngology [16-20]. In periodontal surgery, application of ADMA has been recommended in the management of ridge deformities [15], increasing the zone of attached gingiva around teeth and dental implants [21], and elimination of gingival melanin pigmentation [22].

The aim of the present study was to compare the clinical outcome of root coverage with SCGT and ADMA, during a 6-month post-surgical evaluation.

MATERIALS AND METHODS

The present investigation was an interventional randomized controlled clinical trial. All patients were selected from those referred to the Department of Periodontology, Faculty of Dentistry, Tehran University of Medical Science for treatment of gingival recession defects.

The participants consisted of nine healthy patients (4 females and 5 males) aged 24 to 45 years (mean 35 years). The study sample consisted of 32 teeth associated with recession defects and classified according to the Miller's classification [23]. Only anterior and premolar teeth with ≥2 mm gingival recession on the buccal area were included.

Exclusion criteria were: systemic diseases affectting the periodontium, allergies to medications or materials used in the study, any indication for antibiotic prophylaxis, tobacco use, steroid therapy, pregnancy, poor oral hygiene, uncooperative patients, root surface restorations or active caries on the test or control regions, previous root coverage procedures performed on the test or control sites and teeth with pathologic mobility.

The structure, risks, and benefits of the planned procedures were explained to all subjects and written informed consents were obtained.

Pre-surgical preparation included detailed oral hygiene instructions, scaling and root planning, application of low abrasive polishing paste, and occlusal adjustment when required. A coronally directed roll technique was recommended for teeth with gingival recession, to minimize tooth-brushing trauma to the gingival margins. Surgical treatment of recession defects was not scheduled until the patient was capable of adequate supra-gingival plaque control. Oral hygiene instruction and other pre-surgical procedures were performed by an experienced dental hygienist who was blind to the treatment strategy of the patients.

Clinical periodontal conditions were recorded by measuring Plaque Index (PI) [23], Bleeding Point Index (BPI) [24], Probing Depth (PD), Gingival Recession Depth (RD), Gingival Recession Width (RW) and Clinical Attachment Level (CAL) on the facial aspects of each tooth, immediately prior and 6, 12 and 24 weeks after surgery.

All clinical parameters were assessed by an undergraduate dental student who was unaware of the surgical procedures planned for each patient or site. All measurements were made with a standard Williams style periodontal probe (Hu-Friedy Co., Chicago, USA). The measurements were rounded to the nearest 0.5 mm. Gingival Recession Depth (RD) was assessed from the CEJ to the most apical extension of the gingival margin. Gingival Recession Width (RW), the mesial-to-distal extension of the recession was measured at the level of the CEJ. Probing Depth (PD) was recorded from the gingival margin to the bottom of the sulcus. Clinical Attachment Level (CAL) was assessed from the CEJ to the bottom of the gingival sulcus.

Before surgery, the samples were allocated to test or control groups using the "block randomization" method. The same surgical procedure was applied for both groups, but different materials were employed for root coverage; connective tissue grafts for the control and acellular dermal matrix allografts for the test groups. After root planning with a sharp curette under local anesthesia, an intrasulcular incision was performed with a #15C surgical blade on the buccal aspect of the involved tooth/teeth.

Horizontal incisions were then made, starting at the CEJ of the tooth with recession and extending to the CEJ of the adjacent teeth. In multiple teeth cases, additional horizontal incisions were made, connecting the CEJ of the teeth with the recession. Two oblique releasing incisions were prepared beyond the mucogingival junction. The interdental papillae were left intact so their size and shapes

were preserved. Flap reflection was carried out as partial thickness and the periosteum was left untouched over the existing bone. A mesio-distal and apical dissection parallel to the vestibular lining mucosa was made to release residual muscle tension and facilitate the passive coronal displacement of the flap. The papillae adjacent the tooth/teeth were de-epithelialized to create a bleeding surface for a recipient bed and the grafts were then placed.

The control group was treated with connective tissue grafts. A graft, lacking an epithelial collar, with a thickness of 2-3 mm was dissected from the donor site (palate). Following removal of these grafts, the donor sites were closed using 3-0 silk sutures (Ethicon, Johnson & Johnson. C/0 European Logistics Center; Belgium).

Acellular dermal matrix allograft (AlloDerm; Life cell, The Woodlands, TX) was prepared according to the manufacturer's instructions. The material was rehydrated in two separate dishes containing 50-100 ml sterile saline and was soaked in each dish for a minimum of 5 minutes. Before transferring the graft to the second dish, the backing was removed using sterile gloves or forceps.

The surgical protocol in this study was performed according to the manufacturer's recommendation. In other words, the basement membrane (white) side of the material was placed facing up towards the flap, and the connective tissue (red) side of the graft was placed toward the tooth and bone. Both ADMA and CTG covered the exposed root area and extended at least 3 mm on the bone surrounding the exposed root surface.

After placement of the ADMA/CTG on the recipient site, the graft was secured against the tooth/teeth at the level of the CEJ with a standard sling suturing technique, using a 4-0 bioabsorbable polyglactin 910 suture (Vicryl, Ethicon Inc., Somerville, NJ). Then the pedicle flap was coronally positioned to completely cover the graft and secured with 4-0 bioabsorbable polyglactin 910 sutures. Finally, the releasing incisions were sutured with the simple interrupted method using the same sutures. A periodontal dressing (coe pack, Coe-Lab. Chicago, IL) was then applied, over the surgical site. All patients were instructed to rinse 2 times a day with 0.2% chlorhexidine solution for 2 weeks (each time for one minute), and a non-steroid anti-inflammatory analgesic (Ibuprofen 400 mg q.i.d) was prescribed for pain and swelling. The periodontal dressing and sutures at the palatal donor site were removed after 10 days. The patients were asked to avoid mechanical plaque control until 6 weeks after surgery. Subsequently the patients were instructed to resume mechanical tooth cleaning of the treated areas using a soft toothbrush and a careful roll technique. All participants were recalled for control and prophylaxis every two weeks up to 8 weeks and then once a month until the 6th month. At weeks 6, 12 and 24 after surgery, all measurements were recorded once more by the same student who had measured the baseline parameters.

RESULTS

A total of thirty-two recession sites in nine patients were surgically treated in two groups. At baseline, no statistically significant difference was found between the study groups for any of the measured clinical parameters. The results are shown in Table I.

Table I: Mean (Standard Deviation) of measured parameters in two groups at the base line.

Parameters	Group	
	ADMA	**SCTG**
Bleeding Point Index	0.19 (0.40)	0.19 (0.40)
Plaque Index	0.19 (0.40)	0.37 (0.50)
Probing Depth (mm)	1.62 (0.72)	1.87 (1.36)
Recession Depth(mm)	2.93 (0.93)	3.37 (1.36)
Recession Width(mm)	3.81 (1.04)	3.87 (1.15)
Clinical Attachment Level (mm)	4.56 (1.31)	5.25 (2.02)

The BPI and PI ranged between 0.06-0.37 and 0.19-0.68, respectively. Thus, the mean values of these variables were less than 1 during the study period.

A significant difference was not observed in the mean changes of PD between the 2 groups at any of the time intervals. The mean reduction of RD between baseline and the final examination (week 24) is shown in Table II.

The mean (SD) value of RD decreased from 2.9 (0.92) mm at baseline, to 0.4 (0.66) mm at 24 weeks, representing a mean (SD) reduction of 2.53 (1.1) in the ADMA group. The mean (SD) root coverage was 85.41% (22.67). In the SCTG group, RD decreased from 3.4 (1.4) mm at baseline, to 1.0 (0.93) mm, six months after surgery. The mean change of RD in the SCTG group was 2.31 (1.1), which resulted in a mean root coverage of 69.04% (24.25). The mean reduction of RD from baseline to 24 weeks postsurgery was not significantly different between the ADMA and SCTG groups.

In the ADMA group 11 of the 16 teeth, showed complete root coverage (Figure 1). In other words, 75.0% of the cases in this group had 100% root coverage. In contrast, only five of the sixteen teeth (31.3 %) in the SCTG group revealed complete root coverage (Figure 2). The difference in complete root coverage between the two groups was statistically significant (P=0.034).

The difference in RW reductions was not statistically significant between the two groups (Table II).

Increase in CAL between baseline and 24th week was 3.06 (1.61) mm for the ADMA group and 2.88 (1.82) mm for the SCTG group. However, these changes were not significantly different between the two groups (Table II).

DISCUSSION

The parameters measured in this study included: Bleeding Point Index (BPI), Plaque Index (PI), Probing Depth (PD), Recession Depth (RD), Recession Width (RW) and Clinical Attachment Level (CAL). At baseline, there was no statistically significant difference between the two groups for any of the measured parameters.

No significant changes were found in BPI, PI and PD among the two groups at the 6 month follow-up inspection

Recession Depth significantly decreased from baseline to 24 weeks after surgery (2.5 mm in ADMA and 2.3 mm in SCTG) which resulted in about 85% mean root coverage for ADMA and 69% for SCTG. Although these differences were not statistically significant, the results tended to favour the ADMA procedure.

Similar investigations have obtained highly variable values for mean root coverage [25-27] which may be due to several reasons. Differences in the method and period of the studies and the surgical experience of the clinicians performing the surgeries may in part be responsible for these variations. Mean root coverage (MRC) using ADMA and SCTG were reported

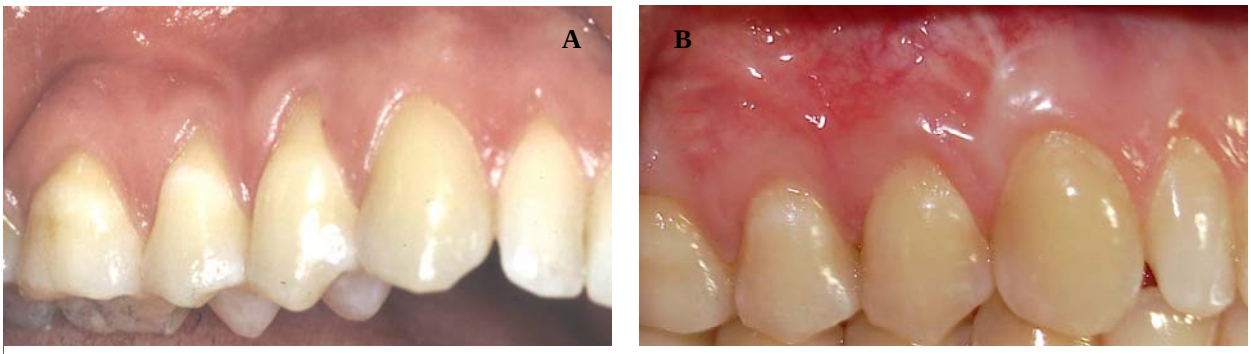

Fig. 1: Preoperative recessions, upper right first and second premolars (A). Six months after coronally advanced flap surgery using ADMA (B).

Table II: The mean (standard deviation) of recession depth, recession with, and clinical attachment level at the base line, 6, 12, and 24 weeks after surgery.

Parameters (mm)		Baseline	6 weeks	12 weeks	24 weeks	Difference between baseline and 24 weeks
Recession Depth	ADMA	4.56 (1.31)	1.69 (1.19)	1.36 (1.19)	1.50 (1.21)	3.06 (1.61)
	SCTG	5.25 (2.02)	2.47 (1.09)	2.44 (1.09)	2.37 (1.31)	2.88 (1.82)
Recession Width	ADMA	1.00 (1.37)	0.93 (1.43)	0.87 (1.45)	2.94 (1.44)	3.81 (1.05)
	SCTG	2.00 (1.26)	1.87 (1.15)	1.87 (1.41)	2.00 (1.67)	3.87 (1.14)
Clinical Attachment Level	ADMA	4.56 (1.31)	1.36 (1.19)	1.19 (1.09)	1.50 (1.21)	3.06 (1.61)
	SCTG	5.25 (2.02)	2.47 (1.09)	2.44 (1.09)	2.37(1.310)	2.88 (1.82)

to be 88.8% and 83.35 by Paolantonio et al [8] and 89.1% and 88.7% by Tal et al [6], respectively. A prominent difference was observed in MRC between these two investigations and the present study when using SCTG. However, MRC achieved by ADMA was comparable between the 3 studies. A possible explanation could be variations in the baseline recession depths. It has been shown that the success rate for cases with shallow recession depths (RD ≤ 3 mm) are lower than the deeper ones [28]. The mean baseline recession depth obtained in the current study was approximately 3 mm which can be considered shallow, especially compared to 4.8 mm and 5.14 mm reported by Paolantonio et al [8] and Tal et al [6], respectively. Therefore it can be hypothesized that in cases with shallow recession depths, using ADMA instead of SCTG may improve the success rates. Further studies should be conducted to ascertain this theory. A possible rationale for this hypothesis could be the uniform thickness of ADMA in comparison to connective tissue grafts obtained from the palate, which may result in the better adaptation of the graft over the exposed root and graft material. This is especially important in shallow recessions and can improve the success rate. In addition, 1 mm root exposure of a treated tooth with an initial recession depth of 2 mm leads to only 50% root coverage; while equal exposure of a treated tooth with 5 mm initial recession depth results in 80% root coverage, which could be assumed a successful result. Therefore, obtaining a higher percentage of root coverage in shallow RD cases is much more technique-sensitive.

Complete root coverage (CRC) was obtained in 11 of the 16 defects (68.8%) treated with ADMA. In contrast, only five out of sixteen defects (31.3%) treated with SCTG, obtained complete root coverage. CRC revealed a statis-

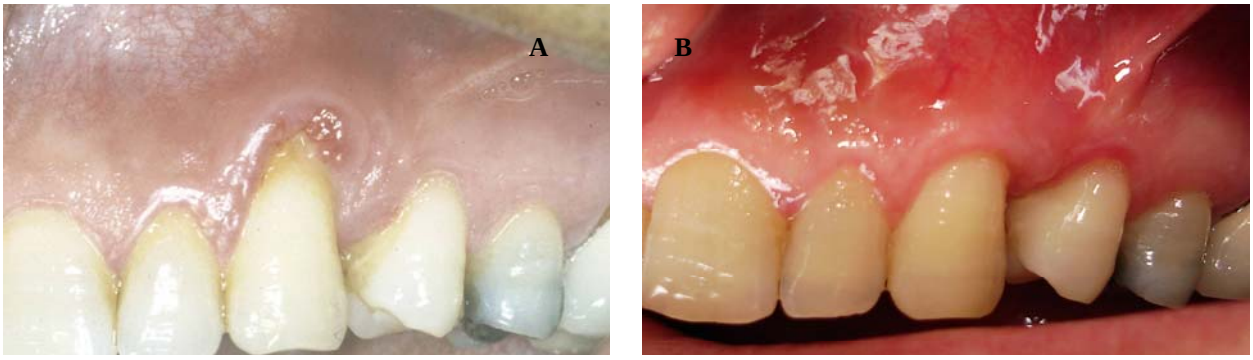

Fig. 2: Initial view of upper left canine presented with recession (A). Six months after surgery with the "subepithelial connective tissue graft" technique (B).

tically significant difference between the two groups. The values of complete root coverage reported in different studies are highly variable [8,25]. The homogenous thickness of ADMA especially in comparison to SCTG may have a positive effect on flap and graft adaptation and therefore may improve the possibility of CRC in shallow recession defects. In both groups, recession width (RW) significantly decreased throughout the observation period. The mean reduction of recession width (RW) from baseline to 24 weeks post-surgery was 2.94 mm in the ADMA group and 2.04 mm in SCTG group. These values were not significantly different between the two groups which were similar to the results obtained by Harris [25].

The mean change of clinical attachment level (CAL) from baseline to the 24th week was similar in both ADMA and SCTG groups. The results of the present study were in agreement with those reported by Novaes et al [26] and Hirsch et al [27]. In the absence of histologic evidence, it is impossible to determine whether this gain in attachment is developed by formation of a long junctional epithelium [29], a new connective tissue attachment, or a combination of both types of healing [30].

CONCLUSIONS

Within the limitations of this study it can be concluded that when the aim of the clinician is to treat a gingival recession, the use of ADMA yields similar results to that of connective tissue grafts with the advantage of avoiding a second surgery for the removal of palatal tissue at the donor site. Although this also holds true for the GTR technique and offers similar results in terms of root coverage, it has been shown that the GTR procedure is not able to increase gingival thickness and is not suggested for cases with initial thin gingival phenotype. Other advantages of ADMA are reduction in operative time and it does not require a specialist or skilled clinician. However, the high cost of ADMA could be considered as a disadvantage of this material.

ACKNOWLEDGMENT

This research has been supported by Dental Research Center/Research council, Medical Sciences/University of Tehran grant number of 2659.

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