

A Comparative 6-Month Clinical Study of Acellular Dermal Matrix Allograft and Subepithelial Connective Tissue Graft for Root Coverag

S. Sadat Mansouri^{1✉}, N. Ayoubian², M. Eslami Manouchehri³

¹Associate Professor, Department of Periodontics, Islamic Azad University, Tehran, Iran

²Assistente Professor, Department of Periodontics, Islamic Azad University, Tehran, Iran

³Dentist

Abstract:

Objective: Different surgical procedures have been proposed for the treatment of gingival recessions. The goal of this study was to compare the clinical results of gingival recession treatment using Subepithelial Connective Tissue Graft and an Acellular Dermal Matrix Allograft.

Materials and Methods: The present study was performed on 5 patients with 9 bilateral Miller's class I or II gingival recessions. This included 15 premolars and 3 canines. In each patient the teeth were randomly divided in two groups of test (ADMA) and control (SCTG). Clinical parameters including recession height (RH), recession width (RW), keratinized gingiva (KG), clinical attachment level (CAL) and probing depth (PD) were measured at baseline, 2, 4 and 6 months after surgery and data analysis was performed using the Wilcoxon signed rank test.

Results: The mean changes (mm) from baseline to 6 months in SCTG and ADMA were 2.22 ± 0.83 and 1.77 ± 0.66 decrease in RH, 2.55 ± 0.88 and 2.33 ± 0.86 decrease in RW, 1.44 ± 0.88 and 2.0 ± 1.11 increase in KG, 2.33 ± 1.22 and 2.11 ± 0.6 decrease in CAL and finally 0.22 ± 0.66 and 0.33 ± 0.7 decrease in PD, respectively. The differences in mean changes were not significant between the two groups in any of the parameters. The percentage of root coverage was 85.7% and 71.1% for the control and test group, respectively. The changes from baseline to the 6 month visit were significant for both groups in all parameters but PD.

Conclusion: Alloderm may be suggested as an acceptable substitute for connective tissue graft considering the root coverage effect and KG width increase.

Key Words: Comparative Study; Gingival Recession; Connective Tissue; Alloderm.

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✉ Corresponding author:
S.Sadat Mansouri, Associate
Professor, Department of
Periodontics, Islamic Azad
University.
drsaeed_sadatmansouri@yahoo.
com
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INTRODUCTION

Gingival recession, which is a popular finding in different societies even among people with a good oral hygiene, refers to the apical movement of the gingival margin under the

cement enamel junction (CEJ) followed by the exposure of root surfaces [1]. Gingival recession is influenced by age; with an 8% prevalence among children and a 100% prevalence in the older than 50 years age

group [2]. The most important etiologic factors resulting in gingival recession would be tooth malposition, traumatic tooth brushing, increasing brushing frequencies, tooth mobility, alveolar bone dehiscence, inadequate attached gingiva, high frenum and muscular attachments and iatrogenic factors related to the location of restoration margin and periodontal treatment procedure [3]. Recession rarely leads to tooth loss but due to its consequences such as heat and tactile sensitivity, esthetic problems and increased root caries potential, root coverage seems necessary [4]. Different root coverage techniques have been already suggested; namely, free soft tissue graft [5], sliding flaps [6], double papilla graft [7], coronally positioned flap [8,9], subpedicle connective tissue graft [10], connective tissue graft and pedicle [11], connective tissue graft and pouch [12] and guided tissue regeneration [13,14]. Although subepithelial connective tissue graft (SCTG), known as the golden standard, provides us with a higher rate of predictability and an acceptable aesthetic with a mean of 89% root coverage [15], its limitation such as the limited amount of available graft and the existence of two surgical sites leads to more inconvenience, pain and bleeding for the patient [16].

Recently, use of an acellular dermal matrix allograft (ADMA) has been proposed as a technique to obtain root coverage [17-23]. Alloderm (ADMA) is derived from the human skin [23]; the epiderm and all dermal cells are eliminated through chemical procedures and the bioactive matrix is preserved and freeze-dried [1].

Through cell elimination, infection resources, disease transfer and immunologic responses are deleted [16].

As a result, the integrity of acellular matrix is preserved and the inflammatory responses are prevented [24-26].

Using Alloderm, acceptable results of SCTG could be achieved without the need to obtain a connective tissue graft from the palate [21]. The amount of root coverage in some short-term studies (6-12 months) through SCTG and ADMA have been mentioned as 97.8%-95.9% [4], 64.9%-66.5% [16], 88.7%-89.1% [23], 70.12%-72.08% [27] and 69.05%-85.42% [28], respectively.

Considering the differences in root coverage, the goal of the present study was to compare the amount of root coverage resulting from ADMA and SCTG associated with coronally advanced flap among patients referred to the periodontics department of the Dental Branch of the Islamic Azad University, Tehran.

Table 1. Mean values \pm SD (mm) of clinical parameters at Baseline & 6-Month examinations

Parameter	SCTG			ADMA			Between-Groups Difference	
	Baseline	6 Month	Difference	Baseline	6 Month	Difference	Baseline	6 Month
RH	2.66 \pm 1.11	0.44 \pm 0.52	P=0.006	2.66 \pm 1.00	0.88 \pm 1.05	P=0.006	NS	NS
RW	3.11 \pm 0.78	0.55 \pm 0.52	P=0.007	3.44 \pm 0.88	1.11 \pm 1.16	P=0.007	NS	NS
KT	2.88 \pm 0.78	4.33 \pm 0.70	P=0.01	2.44 \pm 1.13	4.44 \pm 0.52	P=0.01	NS	NS
CAL	4.22 \pm 1.48	1.88 \pm 0.60	P=0.007	4.22 \pm 1.30	2.11 \pm 1.26	P=0.006	NS	NS
PD	1.55 \pm 0.52	1.33 \pm 0.50	NS	1.55 \pm 0.52	1.22 \pm 0.44	NS	NS	NS

P<0.05 statistically significant

NS: Not Significant

RH: Recessions Height, **RW:** Recession Width, **KG:** Keratinized Gingival

CAL: Clinical Attachment Level, **PD:** Probing Depth

ADMA: Acellular Dermal Matrix Allograft, **SCTG:** Subepithelial Connective Tissue Graf

The subjects were excluded from the study in case of any systemic and autoimmune

MATERIALS AND METHODS

After the approval of the ethical committee by number 15044, this split-mouth randomized clinical trial was performed on 5 patients (2 males-3 females) with the mean age of 37.6 ± 8.26 years (range, 26-47), with a bilateral Miller's class I and II gingival recession greater than 2 mm on 3 canines and 15 premolars. The subjects were excluded from the study in case of any systemic and autoimmune diseases, smoking, history of periodontal surgery during the last 6 months on the mentioned area, taking medicine such as Nifedipine, Phenytoin and Cyclosporine, pregnancy, the presence of any buccal caries or fillings on the intended teeth, negative response to cold test and presence of movable partial prosthesis.

The patients were informed of the type of rendered treatment, agreed to the study protocol, and signed an informed consent prior to treatment.

Scaling and root planing were performed and the plaque index was measured through the O'leary method [29]. After two weeks, the patients were reevaluated and the those with good oral hygiene (plaque index < 15%) were selected. Periodontal parameters included probing depth (PD), recession height (RH) from CEJ to gingival margin, recession width (RW) mesiodistal recession at CEJ, clinical attachment level (CAL) and keratinized gingiva (KG).

To determine the width of the keratinized gingiva, the role test was used. Prior to and 6 months after surgery were recorded in millimeters using Williams probe (Hu-Friedy) and rounded to the nearest 0.5 mm. All surgeries were performed by one person. Following local anesthesia (2% lidocaine with 1:80000 epinephrine) two short horizontal incisions on both sides of the receded root were made at a suitable distance from the top of the papillae.

The upper part of the papillae was de-epithelialized and then two vertical incisions were made and extended apically 2mm beyond the mucogingival junction. The partial thickness flap was elevated and root planing using Gracy's 3/4 curettes was performed. Finally, sterile normal saline was applied to clean the area. SCTG and ADMA were randomly (toss of coin) applied for the control and test groups.

Alloderm (Lifecell, Biohorizen, Birmingham, AL.) at a thickness of 0.89-1.65 mm following rehydration in two saline bowls, according to the company instruction, was trimmed and placed from the basement membrane toward the tooth and periosteum [22].

For the controls, the palatal connective tissue was grafted [11]. All grafts were sutured to the surrounding tissue with two 5-0 silk in the mesial and distal corner through the interrupted technique and covered using the coronally advanced flap and fixed with the sling suture. Finally, the area was covered with periodontal dressing.

Amoxicillin, 500 mg 3 times a day for 7 days and ibuprofen, 400 mg twice a day for 3 days were prescribed. Chlorhexidine digluconate 0.2% was also prescribed twice a day for 15 days.

The patients were explained not to brush the area for 3 weeks and avoid any kind of pressure and trauma. After 15 days, the sutures were removed.

The patients were instructed to clean the surgical area with a cotton pellet soaked in chlorhexidine solution twice a day for 30 days. Clinical examinations and prophylaxis were practiced in recall sessions (at 2, 4 and 6 months post surgery) and RH, RW, KG, CAL, PD were measured and recorded at both sides. Quantitative data were recorded as mean \pm standard deviation.

The Wilcoxon signed rank test was used to analyze whether clinical measurements differed before and after treatment. For all statistical analysis, a significance level of 0.05 was used.



Fig 1a. Pre surgery ADMA



Fig 2a. Pre surgery SCTG



Fig 1b. Post-surgery



Fig 2b. Post-surgery SCTG

RESULTS

The number of 9 pairs of Miller's class I and II gingival recessions in 5 patients (2 males and 3 females) with the mean age of 37.6 ± 8.26 were treated applying SCTG and ADMA. The studied teeth consisted of 15 premolars and 3 canines.

All patients were investigated at 2, 4 and 6 months and the oral hygiene was controlled during this period showing no special problem except for one patient having 4 pairs of recessions. This patient showed a slower healing process during the first two months. The investigated parameters including: RH, RW, KG, CAL and PD are shown in Table 1 displaying similar results for both groups at the baseline.

The recession heights in SCTG and ADMA groups reduced from 2.66 ± 1.11 mm to 0.44 ± 0.52 mm and from 2.66 ± 1.00 mm to 0.88 ± 1.05 mm, respectively, revealing

significant changes. Comparing the two groups, RH did not show any significant difference after 6 months (Table 1).

The changes in RH, RW, KG and CAL were meaningful after 6 months and comparing the groups, the parameter differences were not significant (Table 2).

PD was the only parameter displaying no significant change, which due to its first normal value would be an acceptable result.

The amount of root coverage is shown in Table 3 revealing no significant difference between the two techniques; 85.74% and 71.11% in control and test groups, respectively.

In the SCTG group, 55.55% of the samples showed 100% root coverage and in the ADMA group, 44.44% of the sites had 100% root coverage.

(ADMA Fig 1a & b and SCTG Fig 2a & b)

Table 2. Mean Changes \pm SD (mm) in clinical parameters between Baseline & 6-Month examination

Technique	Parameter				
	RH	RW	KT	CAL	PD
SCTG	2.22 ± 0.83	2.55 ± 0.88	1.44 ± 0.88	2.33 ± 1.22	0.22 ± 0.66
ADMA	1.77 ± 0.66	2.33 ± 0.86	2.00 ± 1.11	2.11 ± 0.60	0.33 ± 0.70
Difference Between Technique	0.272	0.347	0.179	0.622	0.594

$P < 0.05$ statistically significant

RH: Recessions Height, **RW:** Recession Width, **KG:** Keratinized Gingival

CAL: Clinical Attachment Level, **PD:** Probing Depth

ADMA: Acellular Dermal Matrix Allograft, **SCTG:** Subepithelial Connective Tissue Graft

DISCUSSION

The results of this study showed that SCTG and ADMA were effective on root coverage leading to 86% and 71% root coverage in a 6-month period, respectively. The amount of RH, RW, KG and CAL showed significant differences after 6 months in both groups; however, that of PD did not display any change. The average root coverage resulted from using Alloderm in several short-term studies (6-12 months) were reported as 63.9% and 79% [1], 95.9% [4], 66.5% [16], 86% [17], 83.2% [20], 89.1% [23], 72% [27] and 85.42% [28]. The amount of root coverage reported from long-term studies (18-48 months) reduced from 91.7% (12th week) to 87% (18th month) [22] and from 93.4% (6-19 weeks) to 65.8% (48th month) [30]. Therefore, the results gained from this study (71% for ADMA) and (86% for SCTG) matched with those of other studies. Moreover, these results could be compared with 89% root coverage of the SCTG technique, namely the golden standard [15]. It should be noted that these results were influenced by one of the patients possessing 4 pairs of gingival recessions whose healing stages were not satisfactorily due to Alloderm exposure during the several first weeks. If this patient was excluded from the study, the amount of RH reduction would be 2 mm and 1.8 mm in the test and control groups, respectively, resulting in 90% root coverage for both groups.

Such a significant difference is mostly related to Alloderm group, because SCTG, despite its exposure is able to survive [11]. So if it is not covered no problem exists, however, due to the invitality of Alloderm, its revascularization happens only in contact with vital tissues [31,32]. Alloderm exposure, as a result may lead to uncovering of the root. Barros et al [1] proved that through applying the new technique—transferring the vertical incisions to the neighbouring teeth—caused a 79% root coverage as compared with the controls (63%). However, the measured root coverage, in the present study, would be 71% as average in the ADMA group which is more than that of Barros's control group. Therefore, it is suggested that mesiodiastal flap extension may have no special effect on the results. Rahmani et al [27] obtained 70% and 72% root coverage in SCTG and Alloderm groups, respectively, although Harris [33] revealed a 97.4% root coverage using SCTG and double pedicle graft. In Rahmani's study, 55% of the recessions were on premolars while this figure was 16% in Harris's study. In the present study, none of the 9 pairs of recessions were incisors, whereas 83% were on premolars and 17% on canines. Although applying SCTG on various widths leads to successful results[34], it sounds that the increased recession width influences the rate of ADMA success. The recession height in the Alloderm group was 2.66 mm, 1.55 mm, 1.33 mm and 0.88mm at baseline, 2 months, 4 months and 6 months, respectively. The differences in RH between the groups were partially significant at 4 months, however, no statistically significant difference was shown at 6 months between the two groups displaying that both techniques could be effective in root coverage. In this study, reduction in the recession height at 4 to 6 months in the Alloderm group could be attributed to the coronal movement of the gingival margin on the denuded roots following tissue grafts [35]. Creeping attachment starting at one month after graft up to one year, has been referred in several

Table 3. Mean Root Coverage Post Treatment

Treatment Type	Root Coverage(mm)	Root Coverage (%)
SCTG (9 case)	2.22 ± 0.83	85.74 ± 18.72%
ADMA (9case)	1.77 ± 0.66	71.11 ± 28.81%
P-value	0.157	0.293

P<0.05 statistically significant

ADMA: Acellular Dermal Matrix Allograft, **SCTG:** Subepithelial Connective Tissue Graft

studies. Harris [36] referred to 0.85 mm creeping attachment through SCTG following one year and Piniprato et al [37] referred to 0.43 mm through the coronally advanced flap. Whereas, Woodyard et al [38] (from 2 to 6 months) and Henderson et al [19] (from 2 to 12 months) using Alloderm did not show any creeping attachment indicating a high amount of coverage at the beginning with no more healing after 2 months. Although there is no report of creeping attachment using Alloderm in other studies, the only reason of the increase in root coverage in this research maybe should be linked to creeping attachment.

Karring et al [39] pointed out that following the insertion of SCTG under the coronal flap, the connective tissue would be able to induce epithelial cells for keratinization but Alloderm keratinization is not clear. In fact, Alloderm is totally incorporated inside the tissue with no absorption or exfoliation [18,40].

Novaes et al [16] referred that Alloderm could just exist physically under the gingival tissue and could be felt clinically without any keratinization after 6 months. In most studies, the amount of keratinized tissue following the use of ADMA and SCTG are different [4,23]. For example Tal et al [23] showed 107% and 36% increase of KG in the SCTG and ADMA groups, respectively. Barros [1], Novaes [16], Rahmani et al [27] proved no significant changes in KG between the groups after 6 months. In the present study, KG differences after 6 months in Alloderm and connective tissue groups would be 2 mm and 1.4 mm, respectively, which are both significant and with no significant difference between the two groups, the results were the same as Barros [1], Novaes [16] and Rahmani [27] results. Although Harris's [30] short-term study showed KG increase as 1 mm and 2.6 mm for Alloderm and SCTG groups, respectively, revealing a significant increase only for SCTG group, it should be noted that the mentioned study was not a blind type and SCTG was used for cases with less keratinized tissue. Anyway, evaluation of the results based on probe

measurement and rounded figure can definitely yield errors. In order to explain less amount of KG in the Alloderm group compared to the SCTG group, Wei et al [41], in their histologic investigation of two techniques, mentioned that ADMA is not able to induce an appropriate keratinization in the epithelial cells. According to Shin and Mahajan studies [3,24], the iodine test has not been used to evaluate KG in this research. The distance between mucogingival junction and gingival margin has been measured and recorded visually. In cases which specifying mucogingival junction seemed difficult, the role test was carried out. So, similar values of attached gingiva and KG have been obtained. Therefore, the value of KG has merely been referred. It is possible that with an increase in the amount of attached tissue and measuring it between 4-6 months in the Alloderm group, the amount of KG has also been soared.

In the present study, the Alloderm basement membrane, in correspondence with the study of Barros [1], Novaes [16], Harris [22], Tal [23] and Mahjan [24] et al was placed toward the tooth and bone. The most important reason according to Tal et al [23] would be that the connective tissue matrix of Alloderm is placed toward the connective tissue of the covering flap causing vascularization in this way, although Henderson et al [19] claimed that a root coverage of 93% could be achieved apart from Alloderm direction. In some studies reporting less root coverage, such as those by Novaes et al [16], the direction of the connective matrix was toward flap; while, in the study by Aichelman et al [20] its direction was toward the root. In the present study, root planing was the only technique applied for the reduction of root convexities, using this technique, Hirsch et al [4] displayed 95.9% and 97.8% root coverages by Alloderm and SCTG, respectively and Rahmani et al [27] in the same way showed 72% and 70% root coverage. Different techniques are available for root surface preparation. In some studies, use of chemical solutions such as tetracycline

[22,23] and EDTA [1,3] are also suggested for root planing. Tal et al [23] showed 89.1% and 88.7% root coverage in ADMA and SCTG groups, respectively through tetracycline application for root conditioning. Harris [22] also obtained an 87% root coverage using the same material plus ADMA. Barros et al [1] obtained a 63.9%-79% root coverage through the conventional and modified technique, respectively using EDTA for root conditioning along with ADMA. It should be mentioned that none of these studies are able to prove the priority of the chemical solution for root conditioning.

Due to the importance of surgeon experience, it should be noted that all surgical procedures were performed by one skillful surgeon based on similar techniques. The type of suture was (5-0) silk 16 mm which was applied according to single interrupted and sling sutures. The type of suture based on the absorbable type, may play an important role in other studies [22-24], but regarding 100% coverage in 50% of the samples in both groups, the suture type may not play an important effect.

CONCLUSION

It may be concluded that Alloderm is able to yield acceptable results compared to SCTG in treating shallow to moderate gingival recessions, simplifying the surgery, eliminating the need for a second surgical site and permitting the one-stage treatment of an unlimited number of defects.

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