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Acellular dermal matrix allograft versus subepithelial connective tissue graft in treatment of gingival recessions: a 5-year randomized clinical study

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#### Abstract

**Aim:** The present randomized clinical trial compared the long-term results of subepithelial connective tissue graft (SCTG) *versus* acellular dermal matrix allograft (ADMA) in treatment of gingival recessions.

**Materials and Methods:** In 16 patients with bilateral Miller Class I/II gingival recessions, one side was treated with SCTG and the other side with ADMA. Clinical parameters were measured at baseline, 6 months, and at 5 years post-surgery. **Results:** Fifteen patients completed the study. At 6 months, all parameters showed significant improvement in ADMA and SCTG groups [complete root coverage (CRC): 73.3% *versus* 26.7%, p = 0.027; reduction of recession depth (RD):  $2.6 \pm 1.1$  mm *versus*  $2.2 \pm 1.1$  mm, p = 0.376; reduction of recession width (RW):  $3.0 \pm 1.4$  mm *versus*  $2.4 \pm 1.4$  mm, p = 0.207 respectively]. At 5 years, significant relapses were detected in CRC and reduction of RD and RW in both groups with no statistically significant difference (CRC: 20.0% *versus* 13.3%, p = 1.00; RD:  $1.6 \pm 1.2$  mm *versus*  $1.5 \pm 1.4$ mm, p = 0.838; RW:  $1.8 \pm 1.4$  mm *versus*  $1.3 \pm 1.5$ mm, p = 0.367). Patients practicing horizontal toothbrushing habit showed more relapse (OR = 11.2; p = 0.01). Compared with baseline, the gingival width (GW) did not increase in ADMA-treated sites (p = 0.903). **Conclusion:** Five-year results of SCTG and ADMA were similar in terms of CRC

and reduction of RD and RW. Both techniques showed a significant relapse associated with returning to horizontal toothbrushing habit. Increase of GW was stable in SCTG-treated sites, but reached to pre-surgical values in ADMA-treated cases.

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Key words: acellular dermal matrix; connective tissue.; gingival recession; randomized controlled clinical trial; treatment outcome

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# Conflict of interest and source of funding statement

The authors declare that they have no conflict of interest. This study was supported by Dental Research Center of Tehran University of Medical Sciences, with the grant number of 2659. A variety of surgical procedures have been used to cover exposed root surfaces such as laterally positioned flap (Grupe 1966, Zucchelli et al. 2004, Santana et al. 2010a), coronally advanced flap (CAF) (Cairo et al. 2008, Santana et al. 2010b), subepithelial connective tissue graft (SCTG) (Langer & Langer 1985, Nelson 1987, Harris 1992), acellular dermal matrix allograft (ADMA) (Paolantonio et al. 2002, Tal et al. 2002, Gapski et al. 2005), and guided tissue regeneration (Tatakis & Trombelli 2000). Among them, SCTG and CAF with ADMA have shown aesthetically acceptable results in treatment of Miller class I and II gingival recessions (Tatakis & Trombelli 2000, Gapski et al. 2005, Haghighati et al. 2009). Although SCTG has been considered as the "gold standard" technique in treatment of gingival recessions (Chambrone et al. 2008), ADMA with CAF is proposed as an alternative treatment, where harvesting autogenous connective tissue graft is not possible (Chambrone et al. 2010). Based on shortterm results, both techniques were successful and no clear difference was found between them in terms of recession reduction (Aichelmannreidy et al. 2001, Paolantonio et al. 2002, Tal et al. 2002, Barros et al. 2004, Harris 2004). A systematic review and meta-analysis showed that acellular dermal matrix (ADM) in conjunction with CAF has no additional benefit when compared with CAF alone (Cairo et al. 2008).

There is limited information about long-term stability of results of these two techniques.

A retrospective study comparing root coverage procedures with ADMA and SCTG showed that after about 4 years, the results were not stable in sites treated with ADMA, although recession depths (RDs) of sites received SCTG showed no change from 3 months to 4 years (Harris 2004). Another retrospective study showed that 2-year results of root coverage procedures were successful in two groups (Hirsch et al. 2005).

The results from a meta-analysis proposed the necessity of longer period evaluations to investigate the possible instability of outcomes of ADMA (Gapski et al. 2005). In addition, the recent systematic review suggested the need for longterm studies to identify the prognosis and stability of results of each periodontal plastic surgery (Chambrone et al. 2010).

To the best of our knowledge, no randomized controlled clinical trial has compared the long-term outcomes of SCTG versus ADMA in treatment of gingival recessions. The primary aim of this study was to evaluate 5-year results of root coverage procedure with two techniques of SCTG and ADMA.

# Material and Methods

# Study design and participants

The present split-mouth randomized controlled clinical trial was conducted according to guidelines of Helsinki declaration of 1975 revised in 2000. The research protocol was approved by the ethical committee of Dental Research Center of Tehran University of Medical Sciences. The study population consisted of patients referred to the department of Periodontics, Tehran University of Medical Science who presented at least one tooth in two different quadrants with Miller Class I/II gingival recession of at least 2 mm depth. Incisors, canines, or premolars were included. Teeth with cervical caries/restorations and patients affected by relevant systemic conditions/diseases, poor oral hygiene and current smoking habit were а excluded.

The sample size was determined by a statistical power analysis. Considering a significance level of 0.05, (1-a/2) = 1.96, and a power of 95%,  $z_{(1-b)} = 1.64$  and assuming standard deviation of 0.72 (based on the previous pilot study), a total sample size of 28 recession could detect 1-mm inter-group difference in RD. To allow for possible drop-outs, 16 patients (eight females and eight males) were recruited.

## Interventions

Pre-surgical therapy included detailed oral hygiene instruction, scaling, low-abrasive polishing and occlusal adjustment when required. The participants were instructed to a non-traumatizing brushing technique using a soft toothbrush. At least2 months elapsed from instruction of non-traumatic brushing to surgical appointment.

Random allocation sequence was generated using a computerized randomization list. To match the two groups in terms of their location in jaw (upper/lower and left/right), the randomized block method with block sizes of four was used. Enrolment of the patients to random allocation and their assignment to intervention groups were conducted by one who performed the surgical procedures (N. M.). Allocation concealment was obtained by sealed coded containers. The sealed envelopes were opened just before the beginning of the surgeries.

Surgeries were performed from May 2005 to October 2005. In cases with multiple adjacent gingival recessions, only one was enrolled into the study, although all were treated together. The surgical protocol was the same for both groups. Detailed description of surgical protocol has been previously published (Haghighati et al. 2009). Briefly, following gentle planning of exposed roots, intra-sulcular and horizontal incisions extending to the cementoenamel junctions (CEJs) of the adjacent teeth and two oblique releasing incisions were made. A partial thickness flap was raised by sharp dissection. Autogenous connective tissue or ADMA (Alloderm; Life cell, The Woodlands, TX, USA) was placed over the exposed root and surrounding bone. The pedicle flap was then positioned coronally to completely cover the graft and sutured at the level of CEJ.

After surgery, all patients were placed on chlorhexidine rinse twice daily for 2 weeks and non-steroidal anti-inflammatory medication was prescribed for pain relief and alleviation of swelling. Patients were asked to avoid mechanical plaque control of surgical site until 6 weeks. Then, patients were returned to normal mechanical tooth cleaning of the treated areas using roll technique with a soft toothbrush. All patients were recalled for re-instruction and prophylaxis biweekly for 8 weeks and then monthly until 6 months. Patients were returned to their referring dentists for routine preventative visits thereafter. The final follow-up evaluation was performed at 5 years post-grafting.

#### Clinical examinations and questions

Plaque index (PI) (Silness & Loe 1964) and bleeding point index (BPI) (Ainamo & Bay 1975) were used to evaluate hygienic status and gingival health of the patients throughout the study period.

All clinical examinations from baseline to 60 months after intervention were carried-out by a non-calibrated practitioner who was different from the operator. The measurements were rounded to the nearest 0.5 mm. The following measurements were made using a standard Williams-style periodontal probe (Hu-Friedy, Chicago, IL).

- Probing depth (PD): the distance from gingival margin to the bottom of sulcus.
- Recession depth: the distance from CEJ to the most apical extension of gingival margin.
- Recession width (RW): a linear distance from mesial to distal extension of gingival margin at the level of CEJ.
- Gingival width (GW): using folding (role) test, the distance from most apical area of gingival margin to mucogingival line.

# Questionnaire

Recall intervals: Patients were asked about interval of referring to their dentists (regular:  $\leq 1$  year, sporadic: >1 year) (Leknes et al. 2005, Nickles et al. 2010).

Toothbrushing technique: Patients were asked to demonstrate the method of brushing their teeth and it was scored as horizontal or apicocoronal technique (Rajapakse et al. 2007).

# Statistical analyses

Student's paired *t*-test analyses were used for inter-group and intra-group comparisons of clinical parameters. Statistical significance was set at the 95% probability level (p < 0.05). The percentage of mean root coverage was calculated as changes of RD/ baseline RD × 100. Complete root coverage (CRC) was determined by the number of sites with 100% root coverage. Comparison of two groups with regard to CRC was assessed by Chi-square test or Fisher exact test. The CRC was defined as the primary

Table 1.	Descriptive	statistics	of	parameters	at	baseline
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	ADMA $(n = 15)$ Mean $\pm$ SD in mm	SCTG $(n = 15)$ Mean $\pm$ SD in mm
Plaque index	0.13 ± 0.35	$0.33 \pm 0.48$
bleeding point index	$0.20 \pm 0.41$	$0.20 \pm 0.41$
Probing depth	$1.60 \pm 0.73$	$1.86 \pm 1.40$
Recession depth	$2.87 \pm 0.91$	$3.33 \pm 1.39$
Recession width	$3.80 \pm 1.08$	$3.87 \pm 1.19$
Gingival width	$1.90 \pm 1.31$	$1.93 \pm 1.28$

ADMA, acellular dermal matrix allograft; SCTG, subepithelial connective tissue graft.

outcome variable and changes in other parameters (RD reduction, RW reduction and GW increase) were considered as secondary outcome variables.

Change of RD from 6 months to  $60 \pm 2$  months (RD<sub>60-month</sub>-RD<sub>6-month</sub>) was defined as relapse (mm) of root coverage procedure. Bivariate analysis was performed to assess the relabetween tionship relapse (as dependent variable) and toothbrushing technique, recall intervals and method of surgery. The factors that were statistically related to the relapse in bivariate analysis were then entered in multivariate logistic regression model to independently assess the variables related to the relapse.

## Results

Fifteen patients (eight women and seven men; mean age at baseline:  $39.4 \pm 5.2$  years; range: 24-45 years) were available for the final evaluation. The mean follow-up period was  $60.02 \pm 2.29$  months (range: 56–63 months).

At baseline, there were no statistically significant differences between the two groups. The PI and BPI were maintained at relatively low levels during the study period. The mean amount of PD remained less than 2 mm in both groups throughout the study period. No statistically significant difference was seen between the two groups with regard to PD at any time interval (Tables 1 and 2).

#### Complete root coverage

Of 15 patients, 73.3% (11 of 15 sites) and 26.6% (4 of 15 sites) of cases treated with ADMA and SCTG showed CRC at 6 months respectively (p = 0.027). At 5 years, CRC decreased significantly in both groups: 20% (3 sites) and 13.3% (2 sites) in ADMA- and SCTG-treated cases respectively (p = 1.000) (Table 3).

# Percentage of root coverage

At 6 months, the mean percentage of root coverage in ADMA and SCTG groups were  $85.42\% \pm 22.67\%$  and  $69.05\% \pm 24.25\%$  respectively (p = 0.058) (N = 16). The exclusion of one case (who could not attend the final visit) resulted in a significant statistical difference between the two groups with regard to percentage of root coverage (p = 0.017) (Table 3). After  $60 \pm 2$  months, mean root coverage in two groups reduced to  $54.6\% \pm 34.9$  and  $39.8\% \pm 40.6\%$ , respectively with no statistically significant difference (p = 0.294).

#### **Recession depth**

Inter-group comparisons demonstrated that the two groups were not

Table 2. Comparison of ADMA and SCTG groups for parameters recorded 6 and 60 months after surgeries (mean ± SD in mm)

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	$\begin{array}{c} \text{ADMA} \\ (n = 15) \ 6 \ \text{months} \end{array}$	SCTG $(n = 15)$ 6 months	<i>p</i> -value	ADMA $(n = 15)$ 60 months	SCTG $(n = 15)$ 60 months	<i>p</i> -value
Plaque index	$0.40 \pm 0.51$	$0.27 \pm 046$	0.456	$0.20 \pm 0.41$	$0.26 \pm 0.45$	0.679
Bleeding point index	0.00	$0.13 \pm 0.35$	0.153	$0.07 \pm 0.26$	$0.13 \pm 0.35$	0.667
Probing depth	$1.30 \pm 0.45$	$1.50 \pm 50$	0.26	$0.86 \pm 0.35$	$1.20 \pm 0.62$	0.08
Recession depth	$0.30 \pm 0.52$	$1.13 \pm 0.91$	0.005	$1.27 \pm 1.01$	$1.83 \pm 1.09$	0.153
Recession width	$0.77 \pm 1.32$	$1.50 \pm 1.03$	0.102	$2.03 \pm 1.40$	$2.60 \pm 1.34$	0.268
Gingival width	$2.87 \pm 1.14$	$2.73\pm0.79$	0.714	$1.87 \pm 1.20$	$2.70 \pm 1.21$	0.069

ADMA, acellular dermal matrix allograft; SCTG, subepithelial connective tissue graft.

$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	<i>p</i> -value ADMA	SCTG	<i>p</i> -value	ADMA	SCTG	<i>p</i> -value
	(n = 15)	(n = 15)		(n = 15)	(n = 15)	
CRC         11 (68.75%)         5 (33.33%)         0.034         11 (73.33%)         4           Mean RC         85.42% ± 22.67%         69.05% ± 24.25%         0.058         87.77% ± 21.33%         66           ADMA. acellular dermal matrix allosrafi: CRC. complete root coverage: Mean RC. mean root cover         Coverage: Mean RC. mean root coverage	6 months	6 months		60 months	60 months	
Mean RC $85.42\% \pm 22.67\%$ $69.05\% \pm 24.25\%$ $0.058$ $87.77\% \pm 21.33\%$ $66.$ ADMA. acellular dermal matrix allosrafi: CRC. complete root coverage: Mean RC. mean root cover $CRC.$ <td>0.034 11 (73.33%)</td> <td>4 (26.66%)</td> <td>0.027</td> <td>3 (20.0%)</td> <td>2 (13.33%)</td> <td>1.000</td>	0.034 11 (73.33%)	4 (26.66%)	0.027	3 (20.0%)	2 (13.33%)	1.000
ADMA, acellular dermal matrix allograft: CRC, complete root coverage: Mean RC, mean root cover	$0.058 \qquad 87.77\% \pm 21.33\%$	$66.98\% \pm 23.60\%$	0.017	$54.61\% \pm 34.93\%$	$39.84\% \pm 40.61\%$	0.294
A JMA, accliniar dermai matrix allogrant: UKU, complete root coverage: Mean KU, mean root cover			1 . I . I . I .			
	e root coverage; Mean KC, mean root co	verage; ארוש, subep	uthelial conne	cuve ussue grant.		

Table 4. Comparise	on of ADMA and	SCTG for variab	les of RD reductio	in, RW reduction and	GW increase at	6 and 60 months	versus baseline and	at 60 months versus 6 mon	aths in mm
$(\text{mean}\pm\text{SD})$									
	ADMA	SCTG	<i>p</i> -value	ADMA	SCTG	<i>p</i> -value	ADMA	SCTG $(n = 15)$	<i>p</i> -value

	ADMA	SCTG	<i>p</i> -value	ADMA	SCTG	<i>p</i> -value	ADMA	SCTG $(n = 15)$	<i>p</i> -valu
	(n = 15)	(n = 15)		(n = 15)	(n = 15)		(n = 15)	60 months	
	6 months	6 months		60 months	60 months		60 months	versus 6 months	
							versus 6 months		
RD reduction	2.57 ± 1.15	$2.20 \pm 1.08$	0.376	$1.60 \pm 1.22$	$1.50 \pm 1.42$	0.838	$-0.97\pm0.87$	$-0.70 \pm 0.70$	0.365
RW reduction	$3.03 \pm 1.39$	$2.37 \pm 1.43$	0.207	$1.77 \pm 1.43$	$1.27 \pm 1.54$	0.367	$-1.27 \pm 1.19$	$-1.10 \pm 1.14$	0.698
GW increase	$0.97 \pm 1.01$	$0.80\pm1.26$	0.693	$-0.03\pm1.04$	$0.77 \pm 1.27$	0.071	$-1.23 \pm 0.78$	$-0.10\pm1.08$	0.000
ADMA, acellular	dermal matrix allog	raft; GW, gingival v	width; RD, recess	sion depth; RW, rece	ssion width; SCTG	i, subepithelial c	onnective tissue graft.		

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statistically different with regard to reduction of RD at any time interval (Table 4).

Intra-group comparisons showed that changes of RD in ADMA-and SCTG-treated sites were statistically significant throughout the study period [ADMA group: baseline *versus* 6 months: p < 0.001; baseline *versus* 60 ± 2 months: p < 0.001; and 6 months *versus* 60 ± 2 months: p = 0.001; SCTG group: baseline *versus* 6 months: p < 0.001; baseline *versus* 60 ± 2 months: p = 0.001; SCTG group: baseline *versus* 6 months: p < 0.001; baseline *versus* 6 months: p = 0.001].

When categorizing relapse as a dichotomous parameter, 12 sites in ADMA group and 9 sites in SCTG group showed relapse from 6 months to 60 months.

# **Recession width**

The mean values of RW were not statistically different between the two groups at any time interval (Table 2). After  $60 \pm 2$  months, significant increase of RW was observed in both groups, compared with 6-month results (Table 4). Intra-group comparisons showed that RW changed significantly in ADMA (baseline versus 6 months: p < 0.001; baseline versus  $60 \pm 2$  months: p < 0.001; and 6 months *versus*  $60 \pm 2$  months: p = 0.001) and SCTG (baseline versus 6 months: p < 0.001; baseline versus  $60 \pm 2$  months: p = 0.007; and 6 months versus  $\overline{60} \pm 2$  months: p =0.002) groups throughout the study period.

## Gingival width

Inter-group comparisons demonstrated that the differences of mean values of GW were not statistically significant between ADMA and SCTG groups in any time interval (Table 2). Moreover, no statistically significant difference was observed between ADMA- and SCTG-treated sites with regard to changes of GW from baseline to 6 months and from baseline to 60 months after surgery. However, the mean change of GW from 6 months to  $60 \pm 2$  months was statistically higher in ADMA group than SCTG group (p < 0.001) (Table 4).

After 6 months, GW increased significantly in ADMA- and SCTG-

treated sites compared with baseline values (p = 0.002 and p = 0.028 respectively). Sixty months after surgery, the values of GW remained significantly higher than baseline values in SCTG-treated sites (p = 0.036). However, final values of GW were not statistically different from baseline values in ADMA-treated sites (p = 0.903).

# Patient-related analyses

Of 15 patients, seven patients had regular recall programs (at least once in a year). On the other hand, 6 of 15 patients showed vertical toothbrushing technique at final examination. Bivariate analyses showed statistically significant relationship between relapse and toothbrushing technique and patient's recall interval (p = 0.006 and 0.025 respect-)tively); however, method of surgery was not related to relapse (p = 0.232). When considering all these factors in a multivariate analysis only toothbrushing technique showed a relationship with relapse (odds ratio = 11.2, 95% CI: 1.73; 72.30; p = 0.011).

# Discussion

The 6-month results of the present study showed that SCTG and ADMA resulted in mean root coverage of 69% and 84%, respectively, but the difference was not statistically significant (p = 0.054). The higher short-term result for ADMA group may show the concern of site selection that can be attributed to 1) Miller's class III for some of the SCTG-treated sites *versus* majority of Miller's class I or II sites in the ADMA sites and 2) different tissue biotype of the treated groups.

The short-term results of the present study are in accordance with the results of a meta-analysis that demonstrated no statistical significant difference between ADMA and SCTG for mean root coverage (Gapski et al. 2005). When considering CRC as the outcome variable, ADMA showed a better short-term result than SCTG, in contrast to the results reported by another clinical trial (Novaes et al. 2001) and a systematic review (Cairo et al. 2008) in which no significant difference was detected.

At 5 years, significant loss of root coverage was observed in both groups (Figs. 1 and 2). In other words, the mean root coverage reduced by 33% and 27% in ADMA and SCTG respectively. More importantly, 53.3% (9 of 11) and 13.3% (2 of 4) of cases treated with ADMA and SCTG lost CRC from 6 to 60 months (Table 3). There is lack of data with regard to longterm outcomes of root coverage procedures. To the best of our knowlthere were only two edge. retrospective studies in the literature comparing long-term results of ADMA versus SCTG in root coverage procedures (Harris 2004, Hirsch et al. 2005), and this is the first splitmouth randomized clinical trial to provide long-term (5 years) outcomes for the comparison of these two techniques. Stable results were reported with ADMA and SCTG after 2 years (Hirsch et al. 2005). In contrast, another retrospective study showed about 27% relapse of root coverage in cases treated with ADMA, but showed stable results in cases treated with SCTG after about



*Fig. 1.* Two recession defects of a patient treated with subepithelial connective tissue graft (right side) and acellular dermal matrix allograft (left side). (a) Pre-operative gingival recessions. (b) 6 months after surgery. (c) 5 years after surgery. (d) Final periapical radiographs.



*Fig. 2.* Two recession defects of a patient treated with subepithelial connective tissue graft (left side) and acellular dermal matrix allograft (right side). (a) Pre-operative gingival recessions. (b) 6 months after surgery. (c) 5 years after surgery. (d) Final periapical radiographs.

49 months. Moreover, CRC was reported in 24% and 84% of cases treated with ADMA and SCTG respectively (Harris 2004).

The results of a clinical trial showed that initially achieved root coverage of 76% and 71% at 6 months reduced to 68% and 55% after 24 months, using coronally advance flap with and without

ADMA respectively (De Queiroz Cortes et al. 2006). As the final follow-up visit in that study (De Queiroz Cortes et al. 2006) was at 24 months, it is not possible to predict what would be the outcome at 5 years.

The result of the present study is in accordance with the values published in a clinical trial that reported 14.3% CRC and a relapse of 29% for mean root coverage after 120 months using connective tissue grafts (Nickles et al. 2010). In contrast, another controlled clinical trial showed a coronal shift of gingival margin and 52% CRC at 5-year visit in cases treated with connective tissue graft (Pini-Prato et al. 2010). These variations among studies may be due to surgical experience and skill of operators (Cortellini et al. 2009), tissue thickness (Pini-Prato et al. 2010), randomized versus nonrandomized design of the studies (Harris 2004, Hirsch et al. 2005, Pini-Prato et al. 2010), and recall intervals of patients (Harris 2004, Hirsch et al. 2005, Nickles et al. 2010, Pini-Prato et al. 2010). In the present study, although all patients were returned back to their referring dentists for routine check-up programs, about half of them did not have regular visits. Importantly, none of the patients could comply with close follow-up visits (at least twice in a year). Lack of patient compliance may adversely affect the results of the study (Pini-Prato et al. 2010).

Based on multivariate analysis, horizontal tooth brushing habit was the only measured parameter that was significantly related to relapse (OR = 11). Technique of tooth brushing was not evaluated in previous studies; instead it was considered equal with recall intervals. It is not known whether or not non-traumatic tooth brushing technique was reinstructed by referring dentists in each visit or not.

On the other hand, as PI and BPI remained at low levels in all examination intervals (Table 1 and 2), the relapse cannot be explained by poor oral hygiene.

Due to lack of data, comparison of results of RW among studies is not possible. A recent systematic review suggested the inclusion of width of recession in future randomized controlled clinical trials (Chambrone et al. 2010).

When considering GW as the outcome variable, short-term results of this study concur with the results of most other evaluations (Novaes et al. 2001, Paolantonio et al. 2002, Barros et al. 2004, Gapski et al. 2005). The result of this study is consistent with the result of another

prospective study, in which, loss of GW was observed from 6 to 24 months in ADMA-treated sites (De Oueiroz Cortes et al. 2006). The result of this study is in accordance with other studies that reported <1 mm increase of GW, when autogenous connective tissue graft was fully covered by overlying flap (Borghetti & Louise 1994, Bouchard et al. 1994, Cordioli et al. 2001). In studies with no intention to fully cover the connective tissue graft (Harris 2002, 2004, Moses et al. 2006, Nickles et al. 2010), gain of GW was significantly more than the present study, and studies (Barros et al. 2004, Han et al. 2008) in which connective tissue graft was fully covered by the overlying flap.

The limits of this study include lack of close and professional recall visits of patients between 6 and 60 months. In addition, tissue thickness which is an important criterion in treatment outcome was not evaluated in this study. Patient-related outcomes (discomfort, satisfaction, etc...) and aesthetic outcomes evaluated by clinician are other important factors that were not assessed in this study.

## Conclusions

Within the limitations of this study, it can be concluded that:

- No differences between ADMA and SCTG were observed with regard to complete root coverage and reduction of recession at 5year follow-up.
- (2) The root coverage obtained by ADMA and SCTG at 6 months were not maintained at 5 years.
- (3) Root exposure was associated with horizontal tooth brushing techniques.
- (4) Increase of gingival width in SCTG-treated sites was stable from 6 to 60 months, but returned to pre-surgical values in ADMA-treated sites.

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#### References

- Aichelmann-reidy, M. E., Yukna, R. A., Evans, G. H., Nasr, H. F. & Mayer, E. T. (2001) Clinical evaluation of acellular allograft dermis for the treatment of human gingival recession. *Journal of Periodontology* 72, 998–1005.
- Ainamo, J. & Bay, I. (1975) Problems and proposals for recording gingivitis and plaque. *International Dental Journal* 25, 229–235.
- Barros, R. R., Novaes, A. B., Grisi, M. F., Souza, S. L., Taba, M. J. & Palioto, D. B. (2004) A 6month comparative clinical study of a conventional and a new surgical approach for root coverage with acellular dermal matrix. *Journal* of *Periodontology* **75**, 1350–1356.
- Borghetti, A. & Louise, F. (1994) Controlled clinical evaluation of the subpedicle connective tissue graft for the coverage of gingival recession. *Journal of Periodontology* 65, 1107–1112.
- Bouchard, P., Etienne, D., Ouhayoun, J. P. & Nilveus, R. (1994) Subepithelial connective tissue grafts in the treatment of gingival recessions. A comparative study of 2 procedures. *Journal of Periodontology* 65, 929–936.
- Cairo, F., Pagliaro, U. & Nieri, M. (2008) Treatment of gingival recession with coronally advanced flap procedures: a systematic review. *Journal of Clinical Periodontology* 35, 136–162.
- Chambrone, L., Chambrone, D., Pustiglioni, F. E., Chambrone, L. A. & Lima, L. A. (2008) Can subepithelial connective tissue grafts be considered the gold standard procedure in the treatment of Miller Class I and II recessiontype defects? *Journal of Dentistry* 36, 659–671.
- Chambrone, L., Sukekava, F., Araujo, M. G., Pustiglioni, F. E., Chambrone, L. A. & Lima, L. A. (2010) Root-coverage procedures for the treatment of localized recession-type defects: a Cochrane systematic review. *Journal of Period*ontology **81**, 452–478.
- Cordioli, G., Mortarino, C., Chierico, A., Grusovin, M. G. & Majzoub, Z. (2001) Comparison of 2 techniques of subepithelial connective tissue graft in the treatment of gingival recessions. *Journal of Periodontology* 72, 1470–1476.
- Cortellini, P., Tonetti, M, Baldi, C., Francetti, L., Rasperini, G., Rotundo, R., Nieri, M., Franceschi, D., Labriola, A. & Pini Prato, G. (2009) Does placement of a connective tissue graft improve the outcomes of coronally advanced flap for coverage of single gingival recessions in upper anterior teeth? A multi-centre, randomized, double blind, clinical trial. Journal of Clinical Periodontology 36, 68–79.
- De Queiroz Cortes, A., Sallum, A. W., Casati, M. Z., Nociti, F. H., Jr & Sallum, E. A. (2006) A two-year prospective study of coronally positioned flap with or without acellular dermal matrix graft. *Journal of Clinical Periodontology* 33, 683–689.
- Gapski, R., Parks, C. A. & Wang, H. L. (2005) Acellular dermal matrix for mucogingival surgery: a meta-analysis. *Journal of Periodontology* 76, 1814–1822.
- Grupe, H. E. (1966) Modified technique for the sliding flap operation. *Journal of Periodontol*ogy 37, 491–495.

- Haghighati, F., Mousavi, M., Moslemi, N., Kebria, M. M. & Golestan, B. (2009) A comparative study of two root-coverage techniques with regard to interdental papilla dimension as a prognostic factor. *International Journal of Perio*dontics and Restorative Dentistry 29, 179–189.
- Han, J. S., John, V., Blanchard, S. B., Kowolik, M. J. & Eckert, G. J. (2008) Changes in gingival dimensions following connective tissue grafts for root coverage: comparison of two procedures. *Journal of Periodontology* **79**, 1346–1354.
- Harris, R. J. (1992) The connective tissue and partial thickness double pedicle graft: a predictable method of obtaining root coverage. *Jour*nal of Periodontology 63, 477–486.
- Harris, R. J. (2002) Root coverage with connective tissue grafts: an evaluation of short- and long-term results. *Journal of Periodontology* 73, 1054–1059.
- Harris, R. J. (2004) A short-term and long-term comparison of root coverage with an acellular dermal matrix and a subepithelial graft. *Journal* of *Periodontology* 75, 734–743.
- Hirsch, A., Goldstein, M., Goultschin, J., Boyan, B. D. & Schwartz, Z. (2005) A 2-year followup of root coverage using sub-pedicle acellular dermal matrix allografts and subepithelial connective tissue autografts. *Journal of Periodon*tology **76**, 1323–1328.
- Langer, B. & Langer, L. (1985) Subepithelial connective tissue graft technique for root coverage. *Journal of Periodontology* 56, 715–720.
- Leknes, K. N., Amarante, E. S., Price, D. E., Bøe, O. E., Skavland, R. J. & Lie, T. (2005) Coronally positioned flap procedures with or without a biodegradable membrane in the treatment of human gingival recession. A 6-year follow-up study. *Journal of Clinical Peri*odontology **32**, 518–529.
- Moses, O., Artzi, Z., Sculean, A., Tal, H., Kozlovsky, A., Romanos, G. E. & Nemcovsky, C. E. (2006) Comparative study of two root coverage procedures: a 24-month follow-up multicenter study. *Journal of Periodontology* 77, 195 –202.
- Nelson, S. W. (1987) The subpedicle connective tissue graft. A bilaminar reconstructive procedure for the coverage of denuded root surfaces. *Journal of Periodontology* 58, 95–102.
- Nickles, K., Ratka-Kruger, P., Neukranz, E., Raetzke, P. & Eickholz, P. (2010) Ten-year results after connective tissue grafts and guided tissue regeneration for root coverage. *Journal* of *Periodontology* 81, 827–836.
- Novaes, A. B., Jr, Grisi, D. C., Molina, G. O., Souza, S. L., Taba, M., Jr & Grisi, M. F. (2001) Comparative 6-month clinical study of a subepithelial connective tissue graft and acellular dermal matrix graft for the treatment of gingival recession. *Journal of Periodontology* 72, 1477–1484.
- Paolantonio, M., Dolci, M., Esposito, P., D'archivio, D., Lisanti, L., Di Luccio, A. & Perinetti, G. (2002) Subpedicle acellular dermal matrix graft and autogenous connective tissue graft in the treatment of gingival recessions: a comparative 1-year clinical study. *Journal of Periodon*tology **73**, 1299–1307.
- Pini-Prato, G. P., Cairo, F., Nieri, M., Franceschi, D., Rotundo, R. & Cortellini, P. (2010) Coronally advanced flap versus connective tissue graft in the treatment of multiple gingival recessions: a split-mouth study with a 5-year follow-up. *Journal of Clinical Periodontology* 37, 644-650.
- Rajapakse, P. S., McCracken, G. I., Gwynnett, E., Steen, N. D., Guentsch, A. & Heasman, P. A.

(2007) Does tooth brushing influence the development and progression of non-inflammatory gingival recession? A systematic review. *Journal* of *Clinical Periodontology* **34**, 1046–1061.

- Santana, R. B., Furtado, M. B., Mattos, C. M., De Mello fonseca, E. & Dibart, S. (2010a) Clinical evaluation of single-stage advanced versus rotated flaps in the treatment of gingival recessions. *Journal of Periodontology* 81, 485– 492.
- Santana, R. B., Mattos, C. M. & Dibart, S. (2010b) A clinical comparison of two flap designs for coronal advancement of the gingival margin: semilunar versus coronally advanced flap. *Journal of Clinical Periodontol*ogy 37, 651–658.
- Silness, J. & Loe, H. (1964) Periodontal disease in pregnancy. II. Correlation between oral hygiene

#### **Clinical Relevance**

Scientific rationale for the study: SCTG and ADMA show successful short-term results, however, to the best of our knowledge, there is no randomized controlled clinical trial evaluating the long-term stability of these two techniques. and periodontal condition. *Acta Odontologica Scandinavica* 22, 121–135.

- Tal, H., Moses, O., Zohar, R., Meir, H. & Nemcovsky, C. (2002) Root coverage of advanced gingival recession: a comparative study between acellular dermal matrix allograft and subepithelial connective tissue grafts. *Journal of Periodontology* 73, 1405–1411.
- Tatakis, D. N. & Trombelli, L. (2000) Gingival recession treatment: guided tissue regeneration with bioabsorbable membrane versus connective tissue graft. *Journal of Periodontology* 71, 299–307.
- Zucchelli, G., Cesari, C., Amore, C., Montebugnoli, L. & De Sanctis, M. (2004) Laterally moved, coronally advanced flap: a modified surgical approach for isolated recession-type

*Principal findings:* Both techniques were successful after 6 months. However, the results were not stable after 5 years. Horizontal toothbrushing habit was related to relapse of treated sites.

Practical implications: Patients undergoing root coverage procedure need a defects. Journal of Periodontology 75, 1734-1741.

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very intimate maintenance period along with re-instruction of nontraumatic toothbrushing techniques. This document is a scanned copy of a printed document. No warranty is given about the accuracy of the copy. Users should refer to the original published version of the material.