New Surgical Approach for Root Coverage of Localized Gingival Recession with Acellular Dermal Matrix: A 12-Month Comparative Clinical Study

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ABSTRACT

Background: Acellular dermal matrix graft (ADMG) has been used as an advantageous substitute for autogenous subepithelial connective tissue graft (SCTG). However, the surgical techniques used were primarily developed for the SCTG, and they may not be adequate for ADMG since it has a different healing process than SCTG owing to its different vascular and cellular structures. This study compared the 1-year clinical outcome of a new surgical approach with the outcome of a conventional procedure for the treatment of localized gingival recessions, both performed using the ADMG.

Materials and Methods: The clinical parameters—probing depth, relative clinical attachment level, gingival recession (GR), and width of keratinized tissue—of 32 bilateral Miller Class I or II gingival recessions were assessed at baseline and 12 months postoperatively.

Results: Significant clinical changes for both surgical techniques were achieved after this period, including GR reduction from 3.4 mm presurgery to 1.2 mm at 1 year for the conventional technique and from 3.9 mm presurgery to 0.7 mm at 1 year for the new technique. The percentage of root coverage was 62.3% and 82.5% for the conventional and new techniques, respectively. Comparisons between the groups after this period by Mann-Whitney rank sum test revealed statistically significant greater reduction of GR favoring the new procedure ($p = .000$).

CLINICAL SIGNIFICANCE

Based on the results of this study, it can be concluded that a new surgical technique using an ADMG is more suitable for root coverage when compared with the conventional technique. The results revealed a statistically significant improvement in clinical performance with the ADMG approach.

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Among the various root-coverage procedures, the subepithelial connective tissue graft (SCTG) techniques have achieved the highest level of success and predictability owing to the extra source of blood supply provided by the overlying flap that guarantees the graft survival at the recipient site.[1–6] These techniques were primarily developed for the connective tissue graft, but the use of the auto-

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graft exhibits some disadvantages related to the required second surgical site, such as the associated discomfort, the increased risk of postoperative complications, and the limitation in the number of teeth that can be treated in a single surgery. Therefore, the acellular dermal matrix graft (ADMG) has become increasingly popular as a substitute for the connective donor tissue.[7–16] This allograft is obtained from a human donor skin tissue process that removes its cell components but preserves undamaged the remaining collagen and elastin matrices that function as a scaffold to allow ingrowth by host tissues.[9] The ADMG has a unique healing process, different from that of the autograft in which the incorporation is based on the anastomoses between the blood vessels of the gingival corium and those preexisting in the connective tissue graft[17–20]; the allograft, as an avascular and acellular material, depends exclusively on cells and blood vessels from the recipient site to achieve reorganization.[9]

Despite the differences between the grafts, the ADMG has been used successfully as a subepithelial graft for the treatment of gingival recession through a technique that was developed primarily for the connective tissue autograft (SCTG),[2] achieving mean root coverages of 65.9% and 66.5%, as shown by Aichelmann-Reidy and colleagues and Novaes and colleagues, respectively.[13,14] Considering the ADMG's unique characteristics, such as the absence of blood vessels and cells, it can be suggested that a surgical technique designed specifically for the allograft may improve its performance and possibly obtain superior clinical results.

In the conventional technique for SCTGs, the releasing incisions are placed on the proximal surfaces of the involved tooth, in close proximity to the graft that will be positioned beneath the epithelium.[2] When dealing with the allograft, this procedure may not be adequate because it limits the blood supply and source of cells and could also allow for epithelial invagination, predispose the exposure of the graft, and, as a result, compromise the amount of root coverage.[21]

The purpose of this study was to compare in humans the effectiveness of a new surgical approach with that of a conventional procedure for the treatment of localized gingival recessions with the ADMG, with a follow up of 12 months.

MATERIALS AND METHODS

Study Population

In the present study, 14 patients (mean age 33 ± 7.76 yr) with 16 pairs of gingival recessions at the baseline examination were reevaluated 1 year following the root-coverage procedures. The entry criteria for patients were as follows: (1) they had at least one pair of similar localized contralateral Miller Class I or II gingival recessions ≥ 3 mm, (2) they had no contributory medical history, and (3) they were nonsmokers.

After a plaque-control program, including oral hygiene instructions, scaling and root planing, and crown polishing, the teeth selected from each patient were randomly assigned into test and control groups with a flip of a coin. Both groups were treated with the acellular dermal matrix (Alloderm, LifeCell, The Woodlands, TX, USA) as a subepithelial graft. In the control group this allograft was used exactly as described by the conventional technique proposed by Langer and Langer for the SCTG (Figure 1)[2]; in the test group the new technique as below was applied (Figure 2).

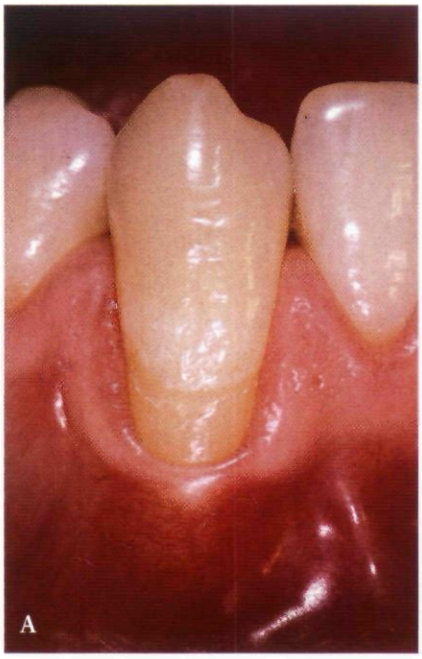
Clinical Parameters

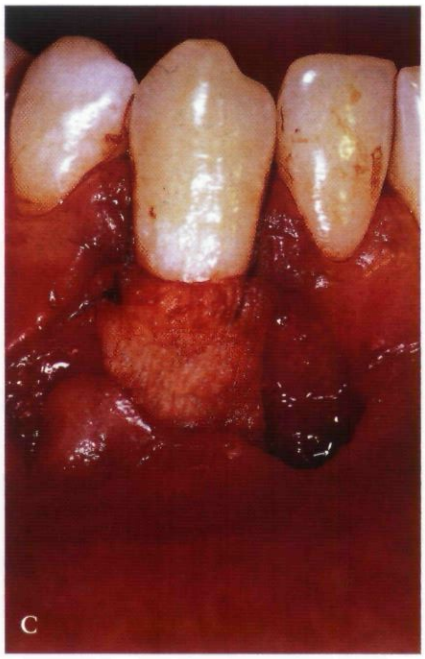
The clinical measurements—gingival recession (GR), probing depth (PD), relative clinical attachment level (RCAL), and width of keratinized tissue (KT)—were assessed by the same examiner at the midbuccal point of the teeth with localized gingival recessions and their adjacent teeth using an automated periodontal probe (Florida Probe, Florida Probe Corporation, Gainesville, FL, USA) and an acrylic stent with reference marks to determine the exact site of measurement at baseline and at 12 months postsurgery. The KT width was assessed after staining the gingival tissues with Schiller's iodine solution.

Surgical Procedures

The same operator performed the control and test surgical procedures at the same clinical appointment.

Following local anesthesia, the flaps were designed to accommodate the ADMG beneath the epithelium. In the control group the releasing incisions were placed on the proximal surfaces of the involved tooth (see Figure 1B), and in the test group the two releasing incisions were displaced to the mesial and distal line angles of the adjacent teeth, distant from the recession, providing a broader flap (see Figure 2B). Subsequently, the same steps were followed for both techniques. Sulcular incisions were made, uniting the





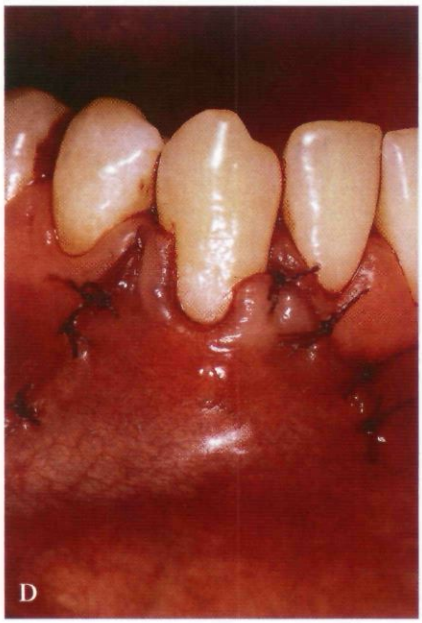


Figure 1. Conventional technique. A, *Preoperative Miller Class I recession on a mandibular left canine.* B, *Partial-thickness flap reflected and delimited by the releasing incisions at the proximal line angles of the involved tooth.* C, *Acellular dermal matrix graft trimmed to the shape and size of the surgical bed and sutured in place.* D, *Flap coronally sutured to completely cover the graft.* E, *Treated area 12 months after surgery.*

releasing incisions, partial-thickness flaps were reflected, and the exposed root surfaces were gently planed and conditioned with a 24% ethylenediaminetetraacetic acid gel preparation for 2 minutes, with subsequent copious rinsing with sterile saline. Finally, the acellular dermal matrix grafts were aseptically rehydrated in sterile saline, trimmed in shape and size to cover the exposed root surfaces without extending the edges of the recessions, and sutured with sling 5-0 Vicryl resorbable sutures (Vicryl,

Figure 2. New technique. A, *Preoperative Miller Class I recession on a mandibular first right premolar.* B, *Partial-thickness flap reflected and delimited by the releasing incisions displaced to the proximal line angles of the adjacent teeth.* C, *Acellular dermal matrix graft trimmed to the shape and size of the surgical bed and sutured in place to cover only the defect of the tooth in question.* D, *Flap coronally sutured to completely cover the graft.* E, *Treated area 12 months after surgery.*

Ethicon–Johnson & Johnson, São José dos Campos, SP, Brazil). The previously reflected partial-thickness flaps were coronally positioned to entirely cover the allografts and were sutured in place with sling 5-0 Vicryl resorbable sutures. The areas were reexamined to ascertain that none of the allografts were exposed and that the flaps were sutured without tension. The vertical incisions were sutured with simple, interrupted 5-0 Vicryl resorbable sutures. A periodontal dressing was applied, changed after 7 days, and removed after 14 days.

All patients were instructed to rinse three times a day with a 0.12% chlorhexidine digluconate solution for 15 days. Amoxicillin (500 mg tid) was prescribed for 7 days, starting 24 hours before the procedures. Discontinuation of toothbrushing and attention to avoiding trauma or pressure at the surgical sites were also recommended during that 7-day period postoperatively. The sutures were removed after 14 days, and the patients were instructed to clean the surgical sites with a cotton pellet soaked in 0.12% chlorhexidine digluconate solution three times a day for 10 days. The participants were recalled after 1 and 2 weeks and monthly up to 12 months for clinical examinations, measurements, and professional hygiene.

Statistical Analyses

Quantitative data were recorded as means ± SD. The Mann-Whitney test was used to determine whether the two groups had similarly sized defects preoperatively, and if one surgical procedure produced a better clinical result after 12 months. The Wilcoxon test was used to analyze whether the clinical measurements differed before and after treatment. For all statistical analyses, the significance level of 5% was adopted.

RESULTS

At the 12-month examination, the 14 patients had no complaints; the results were acceptable to them, accomplishing the objectives of the root-coverage procedures.

Both groups presented similar size defects at baseline, including a similar distribution of Miller Class I and II gingival recessions in each one (Table 1). After 12 months statistically significant differences were achieved in all the parameters evaluated (see Table 1). The only exception was the PD reduction, which was not statistically different after this period in the control group.

After 12 months the mean recession reduction of the test group was superior to that obtained in the control group and this difference was statistically significant ($p = .000$) (Table 2). The percentages of root coverage were 82.5% and 62.3% for test and control groups, respectively. With respect to the other parameters—increase in KT width, PD reduction, and RCAL gain—no statistically significant differences

TABLE 1. MEAN VALUES ± SD OF CLINICAL PARAMETERS AT BASELINE AND 12-MONTH EXAMINATIONS.

	Values with Conventional Technique			New Technique			Between Group Difference*	
Parameter	Baseline (mm)	At 12 Months (mm)	Difference†	Baseline (mm)	At 12 Months (mm)	Difference†	Baseline	At 12 Months
GR	3.4 ± 0.94	1.2 ± 0.64	$p = .000$	3.9 ± 0.87	0.7 ± 0.58	$p = .000$	NS	$p = .000$
KT	2.2 ± 1.53	3.2 ± 1.54	$p = .002$	2.0 ± 1.16	3.3 ± 0.98	$p = .001$	NS	NS
PD	1.6 ± 0.51	1.3 ± 0.55	NS	1.6 ± 0.51	1.0 ± 0.45	$p = .002$	NS	NS
RCAL	14.3 ± 1.60	12.7 ± 1.68	$p = .001$	14.1 ± 1.74	12.2 ± 1.57	$p = .000$	NS	NS

GR = gingival recession; KT = keratinized tissue; NS = not significant; PD = probing depth; RCAL = relative clinical attachment level.
*Between group analysis with Mann Whitney U test; significance level of 5%.
†Intragroup analysis with Wilcoxon signed ranks test; significance level of 5%.

TABLE 2. MEAN CHANGES ± SD OF CLINICAL PARAMETERS BETWEEN BASELINE AND 12-MONTH EXAMINATIONS.

	GR (mm)	KT (mm)	PD (mm)	RCAL (mm)
Conventional technique	2.1 ± 0.89	1.0 ± 0.81	0.3 ± 0.72	1.5 ± 1.14
New technique	3.2 ± 0.75	1.3 ± 0.98	0.6 ± 0.61	1.9 ± 0.12
Difference*	$p = .000$	NS	NS	NS

GR = gingival recession; KT = keratinized tissue; NS = not significant; PD = probing depth; RCAL = relative clinical attachment level.
*Between group analysis with Mann Whitney U test; significance level of 5%.

were found between the groups after 12 months, although the improvements provided by the new technique were numerically greater than those obtained by the control group (see Table 2).

The adjacent teeth of both groups were also evaluated during the study. Data regarding the dimensions of GR, width of KT, PD, and RCAL preoperatively and at 12 months for both groups are presented in Table 3. Both procedures improved all the parameters evaluated at the 12-month examination (Table 3); however, the analysis between the two groups showed statistically significant changes in GR, width of KT, and RCAL in favor of the test procedure (Table 4).

DISCUSSION

In the present study, the results of acellular dermal matrix as a subepithelial graft used in two different root-coverage surgical techniques were compared 12 months postoperatively. The conventional technique, primarily proposed for the SCTG by Langer and Langer,[2] was performed in the control group, whereas the new technique, in which an extended flap was proposed to favor ADMG incorporation, was applied in the test group. The test procedure showed a higher percentage of root coverage (82.5%) when compared to that achieved by the control procedure (62.3%). GR was reduced from 3.9 mm presurgery to 0.7 mm at 1 year for the new technique, and from 3.4 mm presurgery to 1.2 mm at 1 year for the conventional technique. Comparisons between the groups after this period revealed a statistically significant greater reduction of GR favoring the new technique ($p = .000$). These results indicate that the extended flap technique in the treatment of localized gingival recessions with ADMG is better, exhibiting a statistically significant, superior clinical performance when compared with the conventional technique.

TABLE 3. MEAN VALUES ± SD OF CLINICAL PARAMETERS OF ADJACENT TEETH AT BASELINE AND 12-MONTH EXAMINATIONS.

	Values with Conventional Technique			New Technique			Between Group Difference*	
Parameter	Baseline (mm)	At 12 Months (mm)	Difference†	Baseline (mm)	At 12 Months (mm)	Difference†	Baseline	At 12 Months
GR	1.8 ± 1.43	1.4 ± 1.28	$p = .000$	2.4 ± 1.50	0.7 ± 1.02	$p = .000$	NS	$p = .000$
KT	3.2 ± 1.54	3.4± 1.43	$p = .008$	2.4 ± 1.31	3.0 ± 1.09	$p = .000$	$p = .021$	$p = .017$
PD	1.7 ± 0.57	1.2 ± 0.39	$p = .000$	1.4 ± 0.45	1.1 ± 0.47	$p = .002$	NS	NS
RCAL	12.8 ± 1.84	12.2 ± 1.58	$p = .002$	13.0 ± 1.96	11.9 ± 1.43	$p = .000$	NS	$p = .039$

GR = gingival recession; KT = keratinized tissue; NS = not significant; PD = probing depth; RCAL = relative clinical attachment level.
*Between group analysis with Mann Whitney U test; significance level of 5%.
†Intragroup analysis with Wilcoxon signed ranks test; significance level of 5%.

TABLE 4. MEAN CHANGES ± SD OF CLINICAL PARAMETERS OF ADJACENT TEETH BETWEEN BASELINE AND 12-MONTH EXAMINATIONS.

	GR (mm)	KT (mm)	PD (mm)	RCAL (mm)
Conventional technique	0.4 ± 0.57	0.2 ± 1.45	0.4 ± 0.47	0.6 ± 0.98
New technique	1.6 ± 1.04	0.6 ± 0.74	0.3 ± 0.47	1.1 ± 0.84
Difference*	$p = .000$	$p = .017$	NS	$p = .039$

GR = gingival recession; KT = keratinized tissue; NS = not significant; PD = probing depth; RCAL = relative clinical attachment level.
*Between group analysis with Mann Whitney U test; significance level of 5%.

Tal and colleagues and Paolantonio and colleagues also studied the use of ADMG in root-coverage procedures for 12 months but compared it with the use of autogenous grafts (SCTGs).[16,22] The design of the flaps and the ADMG placement were not standardized in those studies. For instance, multiple adjacent recession defects were frequently treated in the same procedure, resulting in the establishment of an extended flap. Therefore, comparisons between those results with the present study are not reliable. Since the purpose of the present study was to compare two techniques for root coverage of localized GR with the ADMG, the elements of the surgical procedures, such as the design and amplitude of the flaps and the placement of the ADMG as described above, were standardized to allow for an appropriate discussion of the results in terms of root coverage obtained in test and control techniques.

In general, the survival capability of grafts at the receptor site represents a great challenge for root-coverage surgical procedures, which is even more challenging when dealing with the ADMG, which is a non-vital graft dependent on host cell infiltration and blood vessel invasion.[9] As stated by Mörmann and Ciancio, who investigated the changes in microcirculation of different surgical incisions and flaps in a fluorescein angiographic clinical study, the flaps should be broad enough at their base to include major gingival vessels.[23] The development of the extended flap technique for root coverage with ADMG shown in this study was based on this principle. In fact, the displacement of the releasing incisions to the proximal line angles of the adjacent teeth favored the incorporation process of the allograft not only by providing more blood vessels, more nutrients, and a better source of cells, but also by allowing easier tissue manipulation, especially in obtaining a tensionless coronally positioned flap to completely cover the allograft. This effort is particularly important because the ADMG has the ability to revascularize only when in direct contact with vital tissues.[16] Finally, the placement of releasing incisions far from the allograft also reduces the possibility of its exposure when compared with the conventional technique, an important factor since this exposure could compromise the root coverage.

The adjacent teeth of both groups were also evaluated during the study to verify whether the inclusion of these teeth in the flap design of the new technique could be detrimental to them. However, the results showed that in spite of this inclusion, the test technique provided statistically significant improvements in the adjacent teeth in terms of GR reduction ($p < .000$), increase in KT width ($p < .017$) and gain in RCAL ($p < .039$) from baseline to the 12-month examination when compared with the control group, probably as a result of the coronal displacement of the flaps.

CONCLUSIONS

The results of this study demonstrate the superiority of the new technique in the treatment of local-

ized gingival recessions with ADMG, presenting a better clinical performance and a statistically significant outcome when compared with the current technique after 12 months of evaluation.

Because the ADMG has become increasingly popular as a substitute for the connective donor tissue in plastic periodontal surgeries, the research of its proper usage is an important achievement. This study describes a new root-coverage technique that emphasizes the necessity of a close blood supply evaluation and a better tissue manipulation when dealing with the ADMG in an attempt to achieve more esthetic and long-lasting results for gingival recession challenges in the esthetic zone.

DISCLOSURE

The authors do not have any financial interest in the companies whose materials are discussed in this article.

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COMMENTARY

NEW SURGICAL APPROACH FOR ROOT COVERAGE OF LOCALIZED GINGIVAL RECESSION WITH ACELLULAR DERMAL MATRIX: A 12-MONTH COMPARATIVE CLINICAL STUDY

Jeff Thomas, DDS*

This comparative study is a focused and simple but effective comparison of two flap designs using ADMG. It drives home the importance of vascular supply regarding incision design when root-coverage procedures are performed.

It is likely more important when using ADMGs than when using SCTGs to ensure attention to vascular details, as the article describes, as there seems to be more forgiveness clinically with SCTGs. The use of an ADMG for root coverage is quite technique sensitive and in my opinion is still an emerging technology, not only in technique but in diversity of clinical application. The reality is that even though this comparative study clearly illustrates the importance of respecting the vascular supply to the ADMG, currently we seldom use the flap design illustrated in the article as we use vertical incisions infrequently (further respecting graft blood supply).[1] The infrequent exceptions are typically when there is extreme recession and problems with vertical passive flap mobility or when lateral and undermining incisions cannot be accomplished for anatomic or esthetic reasons.

It is important for clinicians to have scientific support, as this study provides, to validate clinical impressions and to further advance the art and science of soft tissue grafting.

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