Evaluation of Recession Defects Treated With Coronally Advanced Flaps and Either Recombinant Human Platelet-Derived Growth Factor-BB Plus β-Tricalcium Phosphate or Connective Tissue: Comparison of Clinical Parameters at 5 Years

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Background: In a previously reported split-mouth, randomized controlled trial, Miller Class II gingival recession defects were treated with either a connective tissue graft (CTG) (control) or recombinant human platelet-derived growth factor-BB + β-tricalcium phosphate (test), both in combination with a coronally advanced flap (CAF). At 6 months, multiple outcome measures were examined. The purpose of the current study is to examine the major efficacy parameters at 5 years.

Methods: Twenty of the original 30 patients were available for follow-up 5 years after the original surgery. Outcomes examined were recession depth, probing depth, clinical attachment level (CAL), height of keratinized tissue (wKT), and percentage of root coverage. Within- and across-treatment group results at 6 months and 5 years were compared with original baseline values.

Results: At 5 years, all quantitative parameters for both treatment protocols showed statistically significant improvements over baseline. The primary outcome parameter, change in recession depth at 5 years, demonstrated statistically significant improvements in recession over baseline, although intergroup comparisons favored the control group at both 6 months and 5 years. At 5 years, intergroup comparisons also favored the test group for percentage root coverage and change in wKT, whereas no statistically significant intergroup differences were seen for 100% root coverage and changes to CAL.

Conclusions: In the present 5-year investigation, treatment with either test or control treatments for Miller Class II recession defects appear to lead to stable, clinically effective results, although CTG + CAF resulted in greater reductions in recession, greater percentage of root coverage, and increased wKT. *J Periodontol 2014;85:1361-1370.*

KEY WORDS

Case-comparison studies; connective tissue; gingival recession; guided tissue regeneration; platelet-derived growth factor BB; transplants.

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Achieving successful long-term clinical outcomes is the primary goal in treating the functional and esthetic problems resulting from gingival recession (GR). These clinical problems (e.g., chronic dentinal sensitivity, esthetic deficiencies, poor plaque control) require effective surgical interventions that result in minimal short- and long-term sequelae. A number of systematic reviews have examined a range of therapeutic approaches to recession defects, including the coronally advanced flap (CAF) alone, CAF in combination with the subepithelial connective tissue graft (CTG), guided tissue regeneration (GTR), acellular dermal matrix (ADM), and enamel matrix derivative (EMD).[1-12] When examining specific clinical parameters, alternative protocols to CAF + CTG often appear quite effective. However, most current reviews suggest that only CAF + CTG appears to be consistently effective across all measured outcome parameters, especially root coverage stability over time.[1,2,4-9,11-15]

CAF + CTG, although often considered the gold standard for root coverage treatment, has a number of disadvantages: 1) an additional surgery to obtain donor tissue is needed; 2) increased morbidity may result from the harvesting procedure; and 3) a finite amount of autogenous donor tissue is available, restricting the number of possible treated sites per patient visit.[16,17] In addition, evidence suggests that CAF + CTG has limited ability to regenerate missing tissues of the attachment apparatus when treating recession defects. Instead, most studies support healing through either connective tissue adaptation with adjacent root surfaces or a long junctional epithelium.[17-22] As a result of these disadvantages, along with limited ability to effect true periodontal regeneration, alternatives to CAF +CTG continue to be sought.[14,23-33] Recent advances in recombinant growth factor technology may offer viable alternatives to CTG, including the potential to regenerate missing cementum, periodontal ligament, and supporting alveolar bone.

In a published study, McGuire et al.[34] examined growth factor–mediated clinical and histologic results for the treatment of human Miller Class II recession defects treated with a composite graft of recombinant human platelet-derived growth factor-BB (rhPDGF-BB) and β-tricalcium phosphate (β-TCP) in conjunction with CAF. In the randomized controlled trial (RCT) portion of the study, 30 patients with contralateral recession defects ≥3 mm deep and ≥3 mm wide were treated with either CTG (control) or 0.3 mg/mL rhPDGF-BB + β-TCP + an absorbable collagen wound healing dressing (test), each in combination with CAF. At the end of 6 months, both the test and control treatments demonstrated significant improvements from baseline. Statistically significant results favoring CTG included recession depth reduction, percent root coverage, and recession width reduction, whereas mid-buccal probing depth reduction (PDR) favored the growth factor–mediated treatment. There were no statistically significant differences detected between test and control groups for height of keratinized tissue (wKT), patient satisfaction, and esthetic results. According to the authors, at 6-month follow-up, both test and control treatments appeared to be viable alternative treatments for Miller Class II recession defects.[34,35]

Although 6-month follow-up durations yield valuable outcome information, longer-term data validating stable recession treatment clinical results over time are desirable. Systematic reviews of GR RCTs require at least a 6-month post-surgery follow-up and often extend an additional 6 months.[2,3,6,8-12] Occasionally, longer RCT follow-up times extending to 2 years post-grafting are included in systematic reviews of GR treatment. Apart from systematic reviews, a number of individually reported studies examining a variety of treatment protocols extend GR treatment follow-up times from 4 to 14 years, reporting a wide range in stability of outcome measures initially reported at 6 to 12 months.[36-40] The purpose of the current study is to examine the major patient-centered and clinical quantitative parameters initially reported by McGuire et al. in 2009,[34] ≥5 years after original treatment with either CTG or rhPDGF-BB + β-TCP + an absorbable collagen wound healing dressing, each in conjunction with CAF.

MATERIALS AND METHODS

Study Population

Of the 30 patients completing the original study, 20 were available for follow-up ≥5 years after the original recession-related surgery. The 40 evaluated sites were distributed among incisors, canines, and premolars, the majority of which (36 sites) were located in the maxilla. Canine sites predominated, with 28 in the maxilla and two in the mandible. None of the follow-up patient population (three males and 17 females, aged 29 to 68 years; mean age: 52.5 years) smoked. Generally, the follow-up patients were healthy and without significant medical problems.

Patient Population Lost to Follow-Up

Ten of the original 30 patients were lost to follow-up. Five chose not to participate, and three could not be located. In the remaining two, the cemento-enamel junction (CEJ) reference point was obscured by restorations. Overall the loss to follow-up appeared unrelated to recession treatment outcomes. The study protocol was approved by the IntegReview institutional review board. Study patients gave informed written consent to participate in the study.

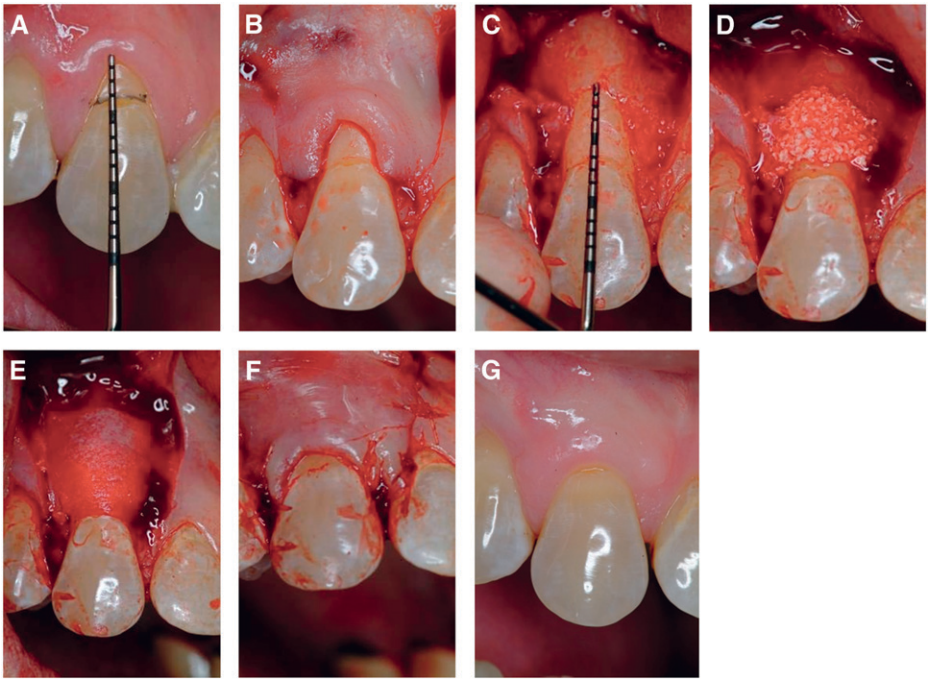

Figure 1.
A) *At baseline, a maxillary canine randomized to receive test (rhPDGF-BB + β-TCP) treatment.* ***B)*** *Full-thickness flap elevation with divergent releasing incisions beyond the mucogingival junction.* ***C)*** *Intraoperative measurements after flap elevation.* ***D)*** *rhPDGF-BB + β-TCP placed over the root surface several millimeters apical to the CEJ.* ***E)*** *Collagen dressing sutured in place over the grafted root surface.* ***F)*** *Mucogingival flap coronally advanced to the level of the CEJ and secured with sutures.* ***G)*** *Six-month follow-up with no evidence of GR.*

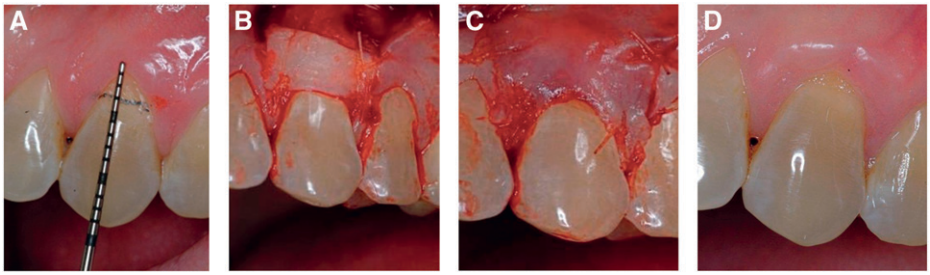

Figure 2.
A) *At baseline, the contralateral canine randomized to receive control (CTG) treatment.* ***B)*** *Subepithelial CTG (control) is sutured over the denuded root surface.* ***C)*** *Mucogingival flap coronally advanced to the level of the CEJ and secured with sutures.* ***D)*** *Six-month follow-up with 0.5 mm GR.*

Summary of Original Surgery

The surgical protocol for the test treatment was CAF + rhPDGF-BB + β-TCP‡ + an absorbable collagen wound healing dressing,§ and that for control treatment was CAF + CTG. Both test and control sites were surgically treated as described by McGuire and Scheyer[41] in their initial feasibility study, with the following exception: an absorbable collagen wound healing dressing saturated with rhPDGF-BB was placed over the grafted test root surfaces in place of a collagen membrane (Figs. 1 and 2). The first surgery was performed on the left side in all patients, with the contralateral surgery immediately following. For all 30 patients, postoperative oral hygiene instructions were designed to minimize trauma at the gingival margins, and follow-up continued through month 6.

Clinical Evaluation 5 Years After Original Surgery

As performed for the original RCT 5 years earlier, the treated sites were clinically examined, measurements were recorded, and clinical photographs taken (Fig. 3). The same examiner (Carol Waring, RDH, Perio Health Professionals, Houston, TX) who recorded the original study measurements was still masked and performed the follow-up 5-year examinations after being recalibrated for measurement accuracy and consistency. The primary efficacy parameter was the change in the depth of the recession defect. Secondary efficacy parameters included the following: 1) probing depth (PD); 2) clinical attachment level (CAL); 3) wKT; 4) percentage of root coverage; 5) percentage of patients with 100% root coverage; 6) root dentin hypersensitivity; 7) clinician rating of color (compared with adjacent tissue); 8) clinician rating of texture (compared with adjacent tissue); and 9) patient satisfaction at 5 years.

At baseline, there were no observed significant differences between test and control sites. All quantitative and qualitative outcome parameters were defined and measured exactly as in the original 6-month study protocol.

Patient satisfaction at 5 years was assessed by responses to the following questions: 1) How satisfied were you with the outcome? 2) At which site did you experience the most discomfort? 3) If you needed treatment again, which side would you choose, left treatment or right treatment?

‡ GEM 21S, Osteohealth, Shirley, NY.
§ CollaTape, Integra LifeSciences, Carlsbad, CA.

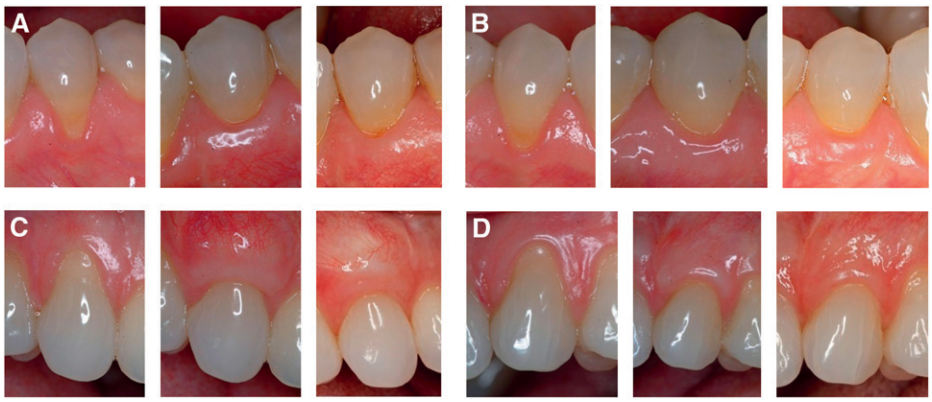

Figure 3.
*Representative control **(A** and **C)** and test **(B** and **D)** sites at baseline (preoperative; left), 6 months postoperative (middle), and 5 years postoperative (right).*

Statistical Analyses

Qualitative measures, including root hypersensitivity, soft tissue color (compared with adjacent tissue), and soft tissue texture (compared with adjacent tissue), were analyzed by their original categories. Specifically, root hypersensitivity was in four categories: 1) none; 2) mild; 3) moderate; and 4) severe, indicating the severity of root hypersensitivity. Soft tissue measures compared with adjacent tissue were in three categories: 1) more red, 2) less red, and 3) equally red for soft tissue color and; 1) more firm, 2) less firm, and 3) equally firm for soft tissue texture. The Bowker test (an extension of the McNemar test for paired measurements with >2 categories) was used to test for changes in qualitative outcomes from baseline to 5 years.

Within-treatment comparisons across time and between-treatment comparisons at each point in time were made using non-parametric tests. Likewise, all change comparisons (baseline versus 6 months and baseline versus 5 years) both within and between treatments were made using non-parametric tests. In particular, for continuous outcomes (recession depth, PD, CAL, wKT, and percent root coverage), a Wilcoxon signed-rank test was used. For the binary outcome of patients with 100% root coverage between test and control sites, Fisher exact test comparing two binomial proportions was used. For comparing the same sites at 6 months versus 5 years within each treatment for proportion of patients with 100% root coverage, McNemar test was used.

RESULTS

Five-Year Assessment of Quantitative Parameters

GR depth, average percentage root coverage, and percentage with 100% root coverage. The primary efficacy endpoint of this study is change in recession depth. At both 6 months and 5 years, significant improvements compared with baseline (time zero) were achieved for both test and control sites, with mean test reductions of 2.90 and 2.35 mm (P <0.001 at both 6 months and 5 years) and mean control reductions of 3.33 and 3.05 mm (P <0.001 at both 6 months and 5 years) at 6 months and 5 years, respectively (Table 1). Statistically significant differences were noted in GR depth changes between test and control sites from baseline visit to 6 months (P = 0.03), favoring the control group. However, when examining intergroup differences at 5 years, no statistically significant differences in GR depth changes were seen between test and control sites from 6 months to 5 years (P = 0.25), although intragroup mean test changes from 6 months to 5 years were statistically significant (+0.55 mm; P = 0.03), whereas the equivalent intragroup mean control changes were not (+0.28 mm; P = 0.13).

Percentage of root coverage for control and test sites was evaluated. No significant difference in mean percentage root coverage was found among the control sites at 6 months and 5 years (97.9% ± 1.47% and 89.35% ± 4.84%; P = 0.13). However, a significant difference in change was noted among test sites at 6 months and 5 years (89.85% ± 3.57% and 74.1% ± 8.33%; P = 0.03). When comparing test versus control mean percentage root coverage at 6 months and again at 5 years, the intergroup differences were significant at both time points (P = 0.04 at 6 months and P = 0.01 at 5 years), in favor of the control group. However, when comparing the difference in change between control versus test from 6 months to 5 years, no significant difference was seen (P = 0.41) (Table 2).

The percentage of patients with 100% root coverage was not significantly different at 6 months and 5 years within and across test and control sites. Control sites at 6 months and 5 years demonstrated 90% and 75% complete root coverage (P = 0.08), respectively, and test sites demonstrated 70% and 60% complete root coverage, (P = 0.16). Comparison between test and control sites at 6 months and 5 years revealed no statistically significant differences between the treatment modalities (P = 0.24 at 6 months and P = 0.50 at 5 years).

PD, CAL, and KT. Secondary efficacy parameters included PDR, changes in CAL, and wKT. At 6 months, significant improvements in PDRs from baseline

Table 1.

Change in Recession Depth, PD, CAL, and wKT (N = 20 patients, 40 teeth)

Parameter	Baseline		Change Between Baseline and 6 Months		P, Baseline to 6 Months	Change Between Baseline and 5 Years		P, Baseline to 5 Years	Change Between 6 Months and 5 Years		P, 6 Months to 5 Years
	Mean ± SE	SD (min to max)	Mean ± SE	SD (min to max)		Mean ± SE	SD (min to max)		Mean ± SE	SD (min to max)	
GR depth (mm)											
Control	3.40 ± 0.13	0.58 (3 to 5)	−3.33 ± 0.13	0.59 (−5.0 to −2.50)	<0.001	−3.05 ± 0.20	0.87 (−4.0 to −1.0)	<0.001*	0.28 ± 0.14	0.64 (0 to 2)	0.13
Test	3.25 ± 0.12	0.55 (3 to 5)	−2.90 ± 0.13	0.58 (−4.0 to −2.0)	<0.001	−2.35 ± 0.27	1.22 (−4.0 to 0.0)	<0.001*	0.55 ± 0.22	1.00 (0 to 3.50)	0.03*
P, test versus control			0.03*			0.009*			0.25		
PD (mm)											
Control	2.25 ± 0.12	0.55 (1 to 3)	−0.35 ± 0.13	0.56 (−1.00 to 0.50)	0.01*	0.38 ± 0.14	0.60 (−1 to 1)	0.02*	0.73 ± 0.13	0.6 (0 to 2)	<0.001*
Test	2.35 ± 0.13	0.59 (1 to 3)	−0.38 ± 0.14	0.63 (−1.00 to 1.00)	0.02*	0.15 ± 0.14	0.61 (−1 to 1.50)	0.38	0.53 ± 0.11	0.50 (0 to 1.5)	<0.001*
P, test versus control			0.94			0.29			0.28		
CAL (mm)											
Control	4.78 ± 0.18	0.79 (4 to 7)	−2.88 ± 0.20	0.90 (−6.00 to −2.00)	<0.001*	−2.35 ± 0.23	1.04 (−4 to 0)	<0.001*	0.53 ± 0.21	0.92 (−1 to 2.50)	0.03*
Test	4.65 ± 0.15	0.67 (4 to 6.5)	−2.98 ± 0.13	0.57 (−4.00 to −2.00)	<0.001*	−1.95 ± 0.21	0.96 (−3.0 to 0)	<0.001*	1.03 ± 0.25	1.11 (0 to 3.50)	<0.001*
P, test versus control			0.28			0.15			0.04*		
wKT (mm)											
Control	2.05 ± 0.20	0.89 (0.5 to 4.00)	1.23 ± 0.17	0.77 (0.00 to 3.00)	<0.001*	1.63 ± 0.23	1.05 (−0.50 to 3.50)	<0.001*	0.4 ± 0.17	0.75 (−1.5 to 2.5)	0.02*
Test	2.03 ± 0.15	0.68 (1 to 3)	0.93 ± 0.16	0.71 (0.00 to 3.00)	<0.001*	1.00 ± 0.21	0.92 (−0.5 to 3.0)	<0.001*	0.08 ± 0.12	0.54 (−1 to 1.50)	0.70
P, test versus control			0.11			0.02*			0.04*		

P values were obtained using Wilcoxon signed-rank test.
* Statistically significant.

(time zero) were achieved for both test and control sites, with mean test reductions of 0.38 mm (P = 0.02) and mean control reductions of 0.35 mm (P = 0.01) (Table 1). No statistically significant differences, however, were seen at 6 months between test and control PDR (P = 0.94). Likewise, at 5 years no significant differences were noted between test and control mean PDRs (P = 0.29) from baseline. However, when examining intragroup change at 5 years from baseline, a statistically significant increase in mean control PD (0.38 ± 0.14 mm; P = 0.02) was noted, but not in the test group (0.15 ± 0.14 mm; P = 0.38).

No significant difference in mean PD change between test and control groups was observed at 5 years compared with 6 months (P = 0.28). However, highly statistically significant intragroup increases in PD were observed from 6 months to 5 years for both test and control groups (5-year test, 0.53 ± 0.11 mm, P <0.001; 5-year control, 0.73 ± 0.13 mm, P <0.001).

Significant reductions in CAL compared with baseline were observed at both 6 months and 5 years for both test and control sites (P <0.001 at both 6 months and 5 years). Significant intragroup increases in CAL were seen, however, at 5 years compared with 6 months for both test and control groups (test at 5 years, P <0.001; control at 5 years, P = 0.03) (Table 1). When comparing intergroup change differences, there was no significant difference between test and control groups at 6 months compared with baseline (P = 0.28), whereas a significant difference in change was seen at 5 years compared with 6 months in favor of the control group (P = 0.04).

Comparisons of mean changes in wKT at 6 months and 5 years are noted in Table 1. Significant increases in wKT between baseline and 6 months are seen for both test and control sites (P <0.001) and also between baseline and 5 years (P <0.001). Comparison of test versus control changes compared with baseline reveal no statistically significant difference at 6 months (P = 0.11). However, at 5 years the wKT change from baseline between the test and control groups was significantly different (P = 0.02), favoring the control group (Table 1). Likewise, when comparing the change in wKT at 5 years compared

Table 2.
Percentage Root Coverage

Group	6 Months		5 Years		P, 6 Months to 5 Years	Change from 6 Months to 5 Years		Sites with 100% Root Coverage (%)		
	Mean ± SE	SD (min to max)	Mean ± SE	SD (min to max)		Mean ± SE	SD (min to max)	Mean Proportion at 6 Months	Mean Proportion at 5 Years	P, 6 Months to 5 Years
Control	97.90 ± 1.47	6.59 (75 to 100)	89.35 ± 4.84	21.63 (33 to 100)	0.13	8.55 ± 4.65	20.78 (−67 to 0.0)	90	75	0.08
Test	89.85 ± 3.57	15.95 (63 to 100)	74.10 ± 8.33	37.27 (0.00 to 100)	0.03*	15.8 ± 6.03	26.97 (−70 to 0.0)	70	60	0.16
P, control versus test	0.04*		0.01*			0.41		0.24	0.50	

P values were obtained using Wilcoxon signed-rank test for average percentage root coverage and McNemar test comparing same sites with 100% root coverage. Fisher exact test was used when comparing proportion between groups.
* Statistically significant.

with 6 months, the difference again favored the control group ($P = 0.04$). When examining intragroup wKT change from 6 months to 5 years, a statistically significant increase occurred within the control group ($P = 0.02$), whereas the comparable test group comparison remained statistically the same ($P = 0.70$).

Five-Year Assessment of Qualitative Parameters

At 5 years after the original grafting procedures, clinical photos were taken, and a number of qualitative parameters were examined (Fig. 3). To avoid selection bias, images in Figure 3 represent the same grafted sites included in the McGuire et al.[34] 2009 publication. For each qualitative outcome parameter (root dentin hypersensitivity, soft tissue texture compared with adjacent sites, and color equivalence compared with adjacent sites), no statistically significant differences between test and control sites were seen at the end of 5 years.

Also at 5 years, patients were asked to respond to questions related to esthetic satisfaction. Of the 20 test and 20 control sites, 14 sites for each were rated as "very satisfied." In the test group, four sites were rated as "satisfied," one as "unsatisfied," and one as "very unsatisfied." In the control group, the remaining six sites were rated as "satisfied" with the esthetic results 5 years after the grafting procedure. As with the other qualitative parameters, the differences between the two groups failed to achieve statistical significance ($P = 0.72$).

Investigator Versus General Practitioner Follow-Up Care

Of the 20 patients, seven were followed by the investigators (MKM, ETS, board-certified periodontists) and 13 by their referring general practitioners from month 7 after the initial surgery through year 5. As noted in Table 3, significant differences in percentage root coverage and 100% root coverage for both test and control sites were seen, depending on whether follow-up care was given by investigator or general practitioner.

DISCUSSION

Standards of care in today's clinical practice are evidence based, with the source of evidence originating from a hierarchy of study types, from sophisticated RCTs to individual case series and reports. The implied understanding is that evidence derived from well-executed trials is valid, reproducible, and capable of translating into stable, effective, long-term results. The RCTs and case series that dominate the periodontal and dental literature have relatively short study durations, as highlighted by the fact that most systematic reviews include studies with durations from 6 to 12 months, with occasional longer-term studies extending to >2 years.[2,3,6,8-12]

Short study durations, however, tend to minimize the effects time may have on evidence-based therapies by excluding the potential impact time may exert on long-term therapeutic effectiveness. In addition to the current study, there are a number of published individual studies that examine the potential effects time may exert on long-term results stemming from various approaches to root recession treatment.[24,29,34,36,38,40,42]

As in the current study, most long-term recession-related studies compare outcomes of different treatment protocols to CAFs in combination with CTGs (CAF + CTG).[24,29,34,36,38,40,42] In a 5-year follow-up study, Pini-Prato et al.[24] demonstrated a statistically significant difference in complete root coverage between sites treated with CAF + CTG (52%) and CAF alone (35%) ($P = 0.02$). At 6 months after surgery, no statistically significant difference had been observed between the two groups. Interestingly, at 5 years progressive coronal migration of the gingival margin occurred within the CAF + CTG sites, whereas an apical shift of the gingival margin was observed in the CAF-alone sites.

Harris,[36] in a retrospective analysis of 25 patients treated with either CTG or ADM, each with CAF, examined two time points after grafting: 12.3 to 13.2 weeks or 48.1 to 49.2 months. Short-term results revealed no significant differences between the two treatment types on most parameters, especially percent root coverage (CTG 96.6%; ADM 93.4%). Nor was a difference seen at 18.6 months.[42] At 4 years, however, a statistically significant difference was seen in root coverage between ADM- and CTG-treated sites (ADM 65.8%; CTG 97.0%).[36] CTG-grafted sites appeared stable over time, whereas ADM grafted sites exhibited significant regression at 4 years.

Two studies, Nickles et al.[38] and McGuire et al.,[40] with follow-up times up to 10 years demonstrate significantly different long-term outcomes with two different approaches to GR treatment. Comparing CTG to GTR, each in conjunction with CAF, Nickles et al.[38] demonstrated significant root coverage at 6 months compared with baseline for both groups. By 1 year, significant recession was seen in the GTR-treated sites, and at 10 years both the CTG and GTR sites exhibited significant outcome decline from the 6-month time point, with the GTR sites regressing close to baseline. In contrast, the McGuire et al.[40] 10-year evaluation of human recession defects treated with either EMD or CTG, each with a CAF, demonstrated statistically comparable root coverage results for both treatment approaches a decade after initial surgical treatment (89.8% CTG, 83.3% EMD, $P = 0.50$). In addition, on all other study parameters, including increases in wKT, EMD- and CTG-treated sites at 10 years appeared comparable and stable.

In the current study, the primary outcome parameter is the change in recession depth at 5 years compared with time zero (baseline) and 6 months after initial grafting surgery. Significant improvements from baseline were seen for both test and control treatments, although statistically the reduction in recession at 5 years compared with baseline favored the control group. There was, however, no statistically significant difference at 5 years compared with the 6-month time point in GR depth changes between test and control sites. Although there was a statistically significant increase in recession noted for the test sites at 5 years compared with 6 months (0.55 ± 1.00 mm), in clinical terms this difference was quite small and would likely not be significant.

When examining percent root coverage, no statistically significant intergroup comparison change was observed from 6 months to 5 years, although at each time point the mean percentage root coverage favored the control group. When comparing the percentage of sites with 100% root coverage, no statistically significant differences were seen at either 6 months or 5 years between test and control sites. In this study, therefore, direct recession-related parameters appear relatively stable over the 5-year follow-up period, although in absolute terms the trend over time for both test and control sites was some loss of the gains seen at 6 months.

Of interest to both this and other studies are the possible long-term effects that GR treatment protocols have on keratinized tissue. In a 5-year follow-up study of CAF alone in treating 73 Miller Class I and II recession defects, Zucchelli and De Sanctis[37] found statistically and clinically significant increases in wKT. At baseline, 38% of the recession sites had ≤1 mm wKT. At 5 years, 92% of the treated teeth had

Table 3.

Percentage Root Coverage at 5 Years: Routine Patient Follow-Up Care Rendered by Periodontists (n = 7) Versus Referring General Dentists (n = 13)

	Mean Percentage Root Coverage at 5 Years		Sites with 100% Root Coverage at 5 Years (%)	
Follow-Up Clinician	Test	Control	Test	Control
Periodontist	100	100	100	100
General Practitioner	60.2	83.6	38	61

≥3 mm of KT and none had <2 mm of KT. In contrast, Pini Prato et al.[39] at 14 years after CAF found slightly decreased amounts of KT regardless of the type of root modification initially used. In comparing CAF alone to CAF in combination with other therapeutic modalities, Cairo et al.'s systematic review[6] found better outcomes in KT gain when CTG or EMD was used in conjunction with CAF. Comparison between CAF + CTG versus CAF (two RCTs included) led to a mean KT difference of 0.73 mm, P <0.001. Comparison between CAF + EMD versus CAF (five RCTs included) led to a mean KT difference of 0.42 mm, P <0.001, in favor of the combination treatment.

In the current study, significant increases in wKT for both test and control sites are seen between baseline and 6 months and baseline and 5 years. Increases in KT for both treatment groups continued to occur throughout the 5-year follow-up period. However, when comparing the difference in change at 5 years between test and control sites compared with baseline and 6 months, CAF + CTG led to statistically significantly greater amounts of KT at both time points. From a clinical perspective, however, the differences between the treatment types were quite small, suggesting limited clinical significance of these findings (Table 1).

Equally important to the quantitative results were the patient-centered qualitative findings examined in the current study. On all qualitative parameters (root dentin hypersensitivity, tissue texture, tissue color, and esthetic satisfaction), no statistically significant differences were observed between test and control treatments. For patients enrolled in this study, mean patient-centered outcomes were the same regardless of the treatment type.

Finally, closer examination of the data begins to underscore the importance of follow-up care on the long-term stability of recession treatment results achieved at surgery (Table 3). As noted in Table 3, seven patients received follow-up care from the investigators (board-certified periodontists) and 13 from referring general dentists. Of those followed by the investigators, 100% root coverage was achieved by all seven patients from baseline treatment through the study's conclusion at year 5. Of those followed by the referring clinicians, test sites achieved 60.2% root coverage and control sites achieved 83.6% at year 5. Thirty-eight percent of the test sites and 61% of the control sites achieved 100% root coverage by year 5, a dramatic difference from investigator-followed patients.

Although it is impossible from this retrospective study to determine all the potential differences in follow-up care that might explain the disparate results seen among patients followed by investigators and referring clinicians, several factors may be significant. Of the seven investigator-followed patients, five were seen every 3 months and two every 6 months. At each visit, emphasis on proper oral care, especially instructions on atraumatic brushing techniques, were emphasized. At each follow-up encounter, well-trained hygienists performed careful full-mouth periodontal examinations and scaling prophylaxis therapy. In addition, the investigators also examined each patient at these visits, emphasizing the need for proper oral hygiene and continued follow-up care.

Of the 13 general practitioner–followed patients, three were followed every 3 months, one was followed every 4 months, and the remaining nine were followed every 6 months. At each visit scaling and prophylaxis therapy was performed. It is unclear how frequently atraumatic brushing techniques were reviewed with the patients and whether techniques to minimize gingival margin damage were emphasized.

Although additional factors may have contributed to the differences observed in patients followed by investigators versus general practitioners, it is clear that the types of follow-up care significantly impacted the stability of long-term recession-treated results. In the investigator-followed patients, both CAF + CTG and CAF + rhPDGF-BB + β-TCP led to equally effective and stable outcomes over a 5-year period of time. Such diversion of long-term results seen within the same study suggests the need for more formal examination of not only varying surgical approaches to GR, but also of specific follow-up clinical protocols that may protect and preserve initially achieved surgical outcomes.

CONCLUSION

In the present 5-year investigation, treatment with either test or control treatments for Miller Class II recession defects appear to lead to stable, clinically effective results, although CTG + CAF resulted in greater reductions in recession, greater percentage of root coverage, and increased wKT.

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