

A Porcine Collagen Matrix (Mucograft®) vs Connective Tissue Graft in the Treatment of Multiple Gingival Recessions: A Comparative Clinical Study

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ABSTRACT

Aim: The aim of this study was to compare the use of porcine collagen matrix (PCM) (Mucograft®) with coronally advanced flap (CAF) and connective tissue graft (CTG) with CAF in the treatment of multiple gingival recessions (MGRs).

Materials and methods: Ten patients with 48 multiple recessions were enrolled in this study and divided into test group (PCM + CAF) and control group (CTG + CAF). Clinical parameters, such as gingival recession (GR), probing depth (PD), clinical attachment level (CAL), and width of keratinized tissue (WKT) were recorded at baseline and at 6 months follow-up. Root coverage (RC %) and complete root coverage (CRC) were evaluated at 6 months postsurgery.

Results: The mean of GR at baseline was 3.23 ± 0.49 in the PCM + CAF group and 3.25 ± 0.53 in the CTG + CAF group. At 6 months, the mean of GR reduction was 0.17 and 0.08 mm for PCM + CAF and CTG + CAF respectively, and CRC was obtained in 83% in the test group and 71% in the control group. The mean WKT gain was 1.58 mm in the test group and 1.42 mm in the control group ($p < 0.001$).

Conclusion: Within the limitations of this study, using PCM + CAF in the treatment of MGRs is a successful option and could serve as an alternative to CTGs.

Clinical significance: The PCM with CAF represents a clinical and esthetic treatment of MGRs.

Keywords: Collagen matrix, Connective tissue graft, Coronally advanced flap, Multiple gingival recessions.

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INTRODUCTION

Gingival recession is defined as the apical migration of the gingival margin to the cemento-enamel junction (CEJ)

with exposing root surface, and this recession could be localized or generalized.¹ Multiple gingival recessions are more challenging defects for the clinicians, whereas the management of soft tissue is more difficult and the wound healing could be compromised by several factors, such as: Limited blood supply, variations in recession depth, the amount of keratinized tissue, and larger defected area and teeth position.^{2,3} Getting CRC, which is the main goal of periodontal plastic surgery, is the biggest challenge for clinicians and to achieve this goal, many surgical techniques have been performed to treat MGR, some of them by using periodontal flaps such CAF or modified CAF alone or combined with subepithelial CTG, guided tissue regeneration membranes, acellular dermal matrix, platelet-rich fibrin.⁴⁻⁸ Recently, a new systematic review⁶ evaluated the efficacy of periodontal plastic surgery in the treatment of MGR, and CAF procedure in combination with grafts showed the higher variability in terms of CRC. Till now, CTG + CAF is acceptable as the gold standard in mucogingival surgery,⁹ and results in successful, predictable CRC, but this technique requires a second surgery to obtain the graft and that results in bleeding and more pain after surgery, which prompted researchers to investigate alternative materials that match the effective outcomes obtained with CTG.^{5,10}

Recently, a new three-dimensional PCM (Mucograft®; GeistlichPharma, Wolhusen, Switzerland) has been used for soft tissue regeneration.¹¹⁻¹⁸ It consists of two layers: A compact layer, facing the oral cavity, and a thicker, porous layer, facing the tooth (according to the manufacturer). Many studies have been conducted on using PCM in soft tissue augmentation or treating localized GR, but a few of those evaluated the PCM in treating MGRs.¹⁷⁻¹⁹ This study aimed to compare PCM + CAF with CTG + CAF in treating Miller type I/II MGRs.

MATERIALS AND METHODS

Patient Selection

This comparative clinical study consisted of 10 patients (4 male and 6 female), from those attending the the Department of Periodontology at the Faculty of Dentistry in Damascus University in the period between February 2016 and October 2017.

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Inclusion Criteria

- Patient age range from 25 to 45 years with the ability to demonstrate a good oral hygiene.
- Should be periodontally and systemically healthy, and presented at least two sites and a minimum of 2 Miller type I or II MGRs.

Patients who were smokers (more than 20 cigarettes a day) or suffering from systemic diseases, pregnant, and lactating were excluded. The study was approved by the internal Ethical Committee of Damascus University, Damascus, Syria. A written informed consent was obtained from all subjects who participated in the research study. Subjects were divided according to treatment sites into test and control groups. Ten MGR defects were treated in the test group by PCM + CAF and 10 sites in the control group by CTG + CAF.

Clinical Parameters

Clinical parameters were recorded at baseline and 6 months postsurgery and were GR, CAL, PD, and WKT. These clinical parameters were recorded by using calibrated UNC-15 probes (PCP UNC-15, Hu Friedy, Chicago, Illinois). Root coverage percentage, CRC, and color match were evaluated at 6 months postsurgically.

Surgical Procedures

Fourteen days before surgery, all selected patients received a preperiodontal treatment (scaling and root planning). On the day of surgery, patients were prepared with a preoperative rinse of 0.2% chlorhexidine for 1 minute. Both sites were treated in the same surgical session. A full-thickness CAF was elevated in both sites

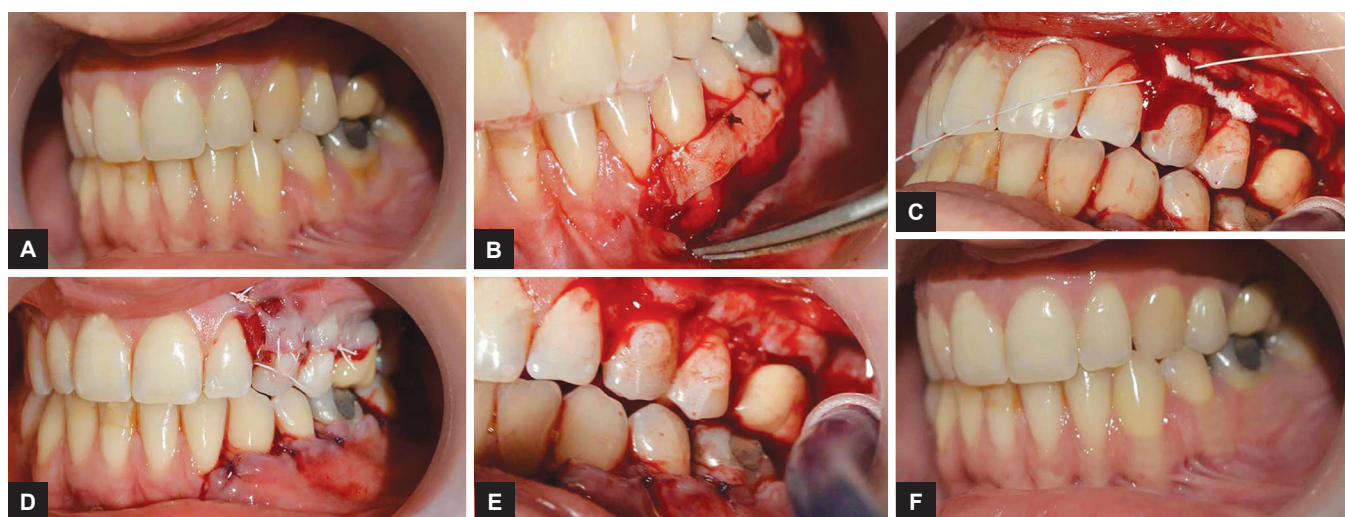
with an intracervical incision and two vertical incisions and freed from tension, then a disepithelialization of the adjacent papillae was performed.

In test sites, the Mucograft[®] was adapted to cover root surface to the CEJ in the recipient area and sutured with Vicryl 5-0 sutures (Johnson and Johnson LLC, Piscataway, New Jersey, USA), then CAF were sutured coronally to the CEJ. Control sites were treated in the same way by elevating a full thickness CAF and a CTG was harvested from the subject's palate and sutured to the recipient site with Vicryl 5-0 sutures (Johnson and Johnson LLC, Piscataway, New Jersey, USA), the CAF were coronally repositioned and sutured (Fig. 1).

Postsurgery, patients were given instruction on a written paper, including to rinse twice daily with chlorhexidine rinse 0.2% and to avoid tooth brushing for a month in the surgical area. Patients took antibiotic amoxicillin/clavulanate potassium (625 gm 3 times daily for 6 days) and nonsteroidal analgesic diclofenac potassium (50 mg, twice a day for 6 days). Patients were told to come 2 weeks after surgery to remove the sutures. All patients were followed up at 1, 3, and 6 months.

Statistical Analysis

Data were analyzed using software Statistical Package for the Social Sciences (version 22 for Windows, IBM, Chicago, Illinois) and expressed as mean ± standard deviations. Pre- and postoperative comparisons of inter- and intragroup parameters were analyzed using paired t-test. Intergroup comparisons were made by using independent t-test. For color assessment, Wilcoxon signed-rank test was used. Statistical significance was set at 95% confidence level with $p = 0.05$.



Figs 1A to F: Representation of test and control sites: (A) MGR in the left maxilla and mandible. (B) A CTG placed to cover the mandibular recessions. (C) Mucograft[®] was sutured and covering the maxillary defects. (D) CAF covering the Mucograft[®]. (E) CAF covering the connective tissue. (F) 6-month follow-up

RESULTS

Ten patients in the age between 20 and 45 with 48 miller type I/II MGR were included (Table 1); 24 recessions were in the test group and 24 recessions in the control. Clinical parameters at baseline and 6-month follow-up were recorded and no significant differences were noticed between groups (Table 2). The GR decreased in the test group from 3.23 ± 0.49 to 0.17 ± 0.28 mm with mean RC of $95.23\% \pm 7.89$ and 71% CRC. In the control group, GR decreased from 3.25 ± 0.53 to 0.08 ± 0.19 mm, corresponding to mean RC of $97.84\% \pm 4.94$ and 83% CRC; WKT increased in both treatment sites with a mean gain of 1.58 ± 0.41 and 1.42 ± 0.32 mm in test and control groups respectively. Both treatment sites showed similar color to the surrounding tissue with no significant differences.

DISCUSSION

Multiple gingival recessions are one of the most esthetically disturbing problems for patients, and to achieve the goal of obtaining a CRC and esthetic appearance, many surgical procedures have been performed. Many studies have treated MGR with combination of periodontal flaps and membranes, such as acellular dermal matrix and platelet-rich fibrin with significant RC.^{7,8} However, just few studies have evaluated the PCM in the management of MGR.

Table 1: Baseline demographic data for test and control groups

Data analyzed	Test group	Control group
Males	4	
Females	6	
Age (years), mean \pm SD	36.60 ± 6.72 (20–45)	
Maxillary GR defects	5	5
Mandibular GR defects	5	5

SD: Standard deviation

Table 2: Mean \pm SD of clinical parameters (in mm) at baseline and 6 months, and difference between baseline and 6 months for test and control groups

Clinical parameter	PCM + CAF (mean \pm SD) (95% CI)	CTG \pm SD (mean \pm SD) (95% CI)	p-value	
GR	Baseline	3.23 ± 0.49 (0.00)	3.25 ± 0.53 (0.00)	0.89
	6 months	0.17 ± 0.28 (0.00)	0.08 ± 0.19 (0.04)	0.24
	Changes from baseline to 6 months	-3.06 ± 0.45 (0.00)	-3.19 ± 0.46 (0.00)	
PD	Baseline	0.85 ± 0.27 (0.00)	0.85 ± 0.31 (0.00)	1
	6 months	0.71 ± 0.25 (0.00)	0.69 ± 0.29 (0.00)	0.77
	Changes from baseline to 6 months	-0.14 ± 0.31 (0.03)	-0.17 ± 0.28 (0.00)	
CAL	Baseline	4.08 ± 0.52 (0.00)	4.10 ± 0.69 (0.00)	0.91
	6 months	0.87 ± 0.34 (0.00)	0.77 ± 0.36 (0.00)	0.3
	Changes from baseline to 6 months	-3.21 ± 0.55 (0.00)	-3.33 ± 0.58 (0.00)	
WKT	Baseline	1.83 ± 0.32 (0.00)	1.75 ± 0.33 (0.00)	0.38
	6 months	3.41 ± 0.50 (0.00)	3.17 ± 0.43 (0.00)	0.07
	Changes from baseline to 6 months	1.58 ± 0.41 (0.00)	1.42 ± 0.32 (0.00)	
RC % at 6 months	95.23 ± 7.89	97.84 ± 4.94		

SD: Standard deviation; CI: Confidence interval

In a case report by Rotundo and Pini-Prato,²⁴ they used the Mucograft® for the treatment of MGR with the envelope flap technique. At 1-year follow-up, CRC was achieved in nine treated sites with a mean keratinized tissue width of 3.1 mm. This study concluded that the use of Mucograft® with CAF is a successful alternative to CTG in the treatment of MGR.

A randomized clinical study by Aroca et al¹⁹ evaluated the collagen matrix with a modified CAF tunnel (MCAT) in the treatment of MGR class I and II of Miller; a 12-month mean RC was 71% in PCM + MCAT vs 90% in CTG + MCAT, and CRC was found at 42% of the test group and 85% of the control group. Also, mean of WKT measured 2.4 mm at test sites and 2.7 at control sites. Another study by Molnár et al²² used collagen matrix with MCAT in treating MGR (a total of 42 recessions in 8 patients) and CRC was obtained in 2 of the 8 patients (71%) and mean RC (84%).

Moreira et al²⁵ reported a clinical case using Mucograft® for RC with CAF in a 4 mm Miller I recession. At 6- and 12-month follow-up, recession was completely covered, and it resulted that using Mucograft® is a successful treatment of Miller type I GR.

A randomized clinical trial by Cardaropoli et al²³ compared XCM with CAF and CAF alone in treating MGRs. The mean RC was 93.25% in the XCM + CAF group with 72% CRC vs 81.49% mean RC and 58% CRC in the CAF group, and it was indicated that XCM + CAF is a suitable option for MGR treatment.

A case report by Deliberador et al²⁰ evaluated Mucograft® as an alternative treatment in the management of MGR in a 33-year-old man who presented with Miller type III GR on two teeth (canine 2.05 mm and first molar 2.00 mm). At 9-, 24-month follow-up, the reduction of GR of the canine area was 0.5 mm and for the first molar, the reduction of GR was 0.8 mm at 9 months and 0.5 mm at 24 months.

A randomized trial study by Tonetti et al²¹ evaluated the noninferiority of a xenogenic collagen matrix (XCM) or CTG to CAF for RC of MGR, and concluded that replacing CTG with XCM shortens time and decreases morbidity.

This study has evaluated the use of Mucograft[®] with CAF in the treatment of MGRs compared with CTG. At 6-month follow-up, the results showed no statistical differences in GR reduction in both groups with a mean of 0.17 in the PCM + CAF group and 0.08 in the CTG + CAF group.

Regarding RC, the PCM + CAF group experienced a mean of 95.23% at 6 months with a 71% CRC, compared with a mean of 97.84% in the CTG + CAF group with 83% CRC, and these findings are comparable to the results obtained from studies that evaluated single GR,¹¹⁻¹⁸ and also agreed with the case report results by Rotundo and Pini-Prato²⁴ and Moreira,²⁵ and with Cardaropoli et al²³ study, and Molnár et al²² study, despite the difference in surgical technique. Our results outperformed the results obtained by Aroca et al,¹⁹ in which it could correlate to the different technique used. However, further clinical studies should be performed to evaluate the efficacy of the procedure.

For PD and Cal parameters, there were no statistical differences between test and control sites and both treatments were statistically significant at 6-month follow-up. For the PCM and CTG groups, the mean CAL gain was 3.21 and 3.33 respectively; also, these findings are consistent with other studies, in which both treatment groups showed a significant gain of CAL.^{19,22-25}

Regarding the WKT, both treatment groups showed a significant increase of WKT at 6 months with a mean gain of 1.58 in PCM group and 1.42 in CTG group. These findings are in agreement with case report studies,^{24,25} and with other studies that treated single GRs.¹¹⁻¹⁸ The increase in CTG group correlated with the ability of the connective tissue to induce keratinization of the epithelium,²⁶ and the gain in PCM group could be explained by the acting of collagen matrix, which was fabricated by pure type I and III collagen, as a three-dimensional scaffold allows the cell ingrowth and repopulation of fibroblast and blood vessels and integrates with the surrounding tissue.²⁷

CONCLUSION

Within the limitations of this study, the PCM with CAF technique provides RC and gain of keratinized tissue and could be a successful, acceptable, and effective alternative to CTG technique in treating MGR, taking into consideration its benefits in reducing the time of surgery and avoiding second surgery.

CLINICAL SIGNIFICANCE

The use of PCM with CAF is an effective and suitable technique in the management of MGRs.

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