Effect of xenogeneic dermal matrix associated with coronally advanced flap in the treatment of single gingival recession: A case series

Laís Fernanda Ferreira Ferraz, Manuela Maria Viana Miguel, Amanda Rossato, Manuela Bafini Fonseca, Ingrid Fernandes Mathias-Santamaria and Mauro Pedrine Santamaria

Sao Paulo State University (UNESP), College of Dentistry, Department of Periodontology, São José dos Campos, São Paulo, Brazil

Abstract

Aim: This case series aimed to evaluate the 6-month outcome of the use of a xenogeneic acellular dermal matrix (XDM) associated with the coronally advanced flap (CAF) technique for the treatment of single gingival recession defects (GR) .

Materials and methods: Ten patients presenting single GR RT1 (mean 3.5 ± 0.5 mm) were included. Bleeding on probing (BoP), probing depth (PD), clinical attachment level (CAL), gingival recession depth (GRD), keratinized tissue thickness (KTT), keratinized tissue width (KTW), dentin hypersensitivity (DH), and aesthetics parameters (professional and patient-centered) were measured.

Results: The treatment provided statistically significant gains in the clinical attachment levels and shallower probing depth. The mean gingival recession reduction (RecRed) was 2.2 ± 0.6 mm, and the percentage of root coverage was 65.3% ± 22.0% after 6 months.

Conclusions: It can be concluded that the XDM associated with the CAF technique presented satisfactory results in terms of root coverage and patient-centered parameters after 6 months. However, comparatives studies that include different approaches should be performed to determine the best approach to use the XDM in single GR treatment.

Keywords: Gingival recession, tooth cervix, heterografts, periodontics, surgical flaps.

Introduction

Gingival recession defects (GR) are highly prevalent conditions in adults and can affect populations that present with poor oral hygiene and high hygiene standards (Löe *et al*., 1992; Serino *et al*., 1994). GR may affect a single tooth or multiple teeth in the same individual (Cairo, 2017), and the presence of this root exposure in the oral environment is frequently associated with dentin hypersensitivity (DH), aesthetic complaints, presence of non–carious cervical lesions or root caries (Pini Prato, 2010; Wang *et al*., 2012; Santamaria *et al*., 2018), which may require clinical intervention.

Correspondence to: Mauro Pedrine Santamaria, Sao Paulo State University (Unesp). Department of Periodontics, Institute of Science and Technology, Sao Jose dos Campos, Sao Paulo, Brazil. Av. Eng. Francisco José Longo, 777, São José dos Campos - SP, Brazil 12245-000. E-mail: mauro.santamaria@unesp.br

Several surgical procedures have been described to improve GR treatment outcomes (Neves *et al*., 2019). The coronally advanced flap (CAF) (de Sanctis and Zucchelli, 2007) is widely used, and its combination with a subepithelial connective tissue graft (CTG) is considered the gold standard procedure to manage this type of condition (Chambrone and Tatakis, 2015). However, the need for a donor site can lead to some disadvantages, such as increased postoperative discomfort and pain, longer surgical time (Cairo *et al*., 2012), increased risk of bleeding, and limitations on the amount of available graft. For this reason, biomaterials may be used as substitutes for autogenous grafts.

Investigations regarding biomaterials associated with root coverage techniques are frequent in the literature. Among them, the most used biomaterials are collagen matrix (CM) (Cardaropoli *et al.,* 2012; Moreira *et al.,* 2016), enamel matrix derivatives (EMD) (Modica *et al.,* 2000; Sangiorgio *et al.,* 2017), and allogeneic acellular dermal matrix (ADM) (Barros *et al.,* 2004; de Resende *et*

al., 2019). Recently, a xenogeneic acellular dermal matrix (XDM—mucoderm®, Botiss, Germany) was proposed as a possible substitute for CTG in periodontal plastic surgery. The XDM is derived from porcine dermis, which undergoes a purification process without causing damage to the tissue architecture. The XDM forms a three-dimensional scaffold that allows in-growth and repopulation of fibroblasts, blood vessels, and epithelium from surrounding tissues (Pabst *et al*., 2014), similar to human connective tissue. The biomaterial is gradually replaced or incorporated by host tissues, allowing the repopulation of autogenous cells into it.

However, information about the effects of XDM in GR is still scarce and is mostly from *in vitro* and *in vivo* investigations (Pabst *et al*., 2014; Rothamel *et al*., 2014; Schmitt *et al.,* 2016). Studies evaluating the use of XDM are mostly related to the increase of peri-implant soft tissue or management of multiple GR (Nocini *et al*., 2014; Cieślik-Wegemund *et al*., 2016; Zafiropoulos *et al*., 2016; Vincent-Bugnas *et al*., 2018; Gürlek *et al*., 2020; Pietruska *et al*., 2019; Cosgarea *et al*., 2020). Further, the literature regarding the combination of CAF + XDM is insufficient because clinical trials have generally assessed the effects of XDM associated with the coronally advanced tunnel flap technique (TUN) in the treatment of multiple GR (Cieślik-Wegemund *et al*., 2016; Pietruska *et al*., 2019; Cosgarea *et al*., 2020). Thus, the aim of this present case series was to evaluate the 6-month outcome of the use of XDM associated with the CAF technique for the treatment of single GR.

Materials and Methods

The study protocol was approved by the Institutional Review Board of Sao Paulo State University, Sao Jose dos Campos, Brazil (CAAE #85955218.9.0000.0077). A total of 10 patients (six women and four men), aged 36 to 64 years (mean age: 48.3 ± 9.3), were selected using the following eligibility criteria: presence of GR RT1 (Cairo *et al*., 2011) on maxillary or mandibular canines or premolars with an identifiable or restored cement–enamel junction (CEJ); periodontally and systemically healthy; no medications taken that may interfere with periodontal tissue health or healing; non–smokers; non–pregnant or lactating; and signed an informed consent form. After recruitment, all participants were included in an etiologic control program, which included oral hygiene instructions (non–traumatic brushing), etiologic information, prophylaxis, scaling, polishing, and occlusal interference removal, when necessary.

A blinded and calibrated evaluator (LF) recorded the following parameters: (1) presence or absence of visible plaque accumulation at the site included in the study; (2) presence or absence of bleeding on probing (BoP) at the site included in the study; (3) probing depth (PD), measured in millimeters using a periodontal probe (UNC-15, Hu-Friedy, Chicago, IL, USA); (4) clinical attachment level (CAL), the distance between the CEJ and the bottom of the pocket measured at the mid-buccal aspect of the tooth, in millimeters; (5) gingival recession depth (GRD), measured at the mid-buccal aspect of the tooth with a pair of dividers and quantified in millimeters using a digital caliper with a precision of 0.01 mm (Mitutoyo, Suzano, SP, Brazil); (6) keratinized tissue thickness (KTT), measured as previously reported (Santamaria *et al.,* 2017a) by perforating the midpoint between the gingival margin and the mucogingival junction using an endodontic spreader (diameter = 0.3 mm, Dentsply Maillefer® Instruments S.A., Ballaigues, VD, Switzerland) and determined as the distance from the spreader tip to the silicone stop (measured with a digital caliper); (7) keratinized tissue width (KTW), measured in millimeters using the pair of dividers and the digital caliper; and (8) DH, evaluated after a 3-second air blast from a triple syringe was applied on the cervical portion of the selected tooth. Patients used a visual analog scale (VAS) to score the DH (0 = no pain, 10 = extreme pain). The clinical parameters were recorded at baseline, 3 months, and 6 months postoperatively (except KTT, which was evaluated only at baseline and 6 months). Additionally, two esthetic evaluations were performed: (1) patient-centered evaluation, using a VAS before and 6 months after procedures, and (2) the root coverage esthetic score (RES), as previously described (Cairo *et al*., 2009), which was performed using a panel of before and after photographs.

Surgical procedures

One operator (MS) performed all surgical procedures. After local anesthesia, the CAF was performed as previously detailed (de Sanctis and Zuccheli, 2007). The trapezoidal flap started with two slightly divergent releasing incisions: mesial and distal to the recession defect. These incisions were linked by a sulcular incision, and then a split-full-split thickness flap was raised in the coronal–apical direction beyond the mucogingival junction. The anatomic inter-dental papillae were depithelialzed, exposing the underlying connective tissue. Following flap elevation, the exposed root surface was gently scaled, and the matrix was sutured at or slightly coronal to the CEJ, after previous hydration (Kasaj *et al*., 2016) using a sterile saline solution for 10 minutes (Figures 1a, 1b, and 1c). The flap was then positioned approximately 2 mm coronal to the CEJ and stabilized with sling sutures, followed by interrupted sutures to close the releasing incisions (Figure 1d).

After surgery, patients were instructed to take antibiotics (amoxicillin 500 mg, every 8 hours for 1 week) and analgesics (sodium dipyrone 500 mg, every 8 hours, as need for pain), use antimicrobial rinse (0.12% chlorhexidine, twice daily for 2 weeks) for plaque control, and discontinue tooth brushing around the surgical

sites for 2 weeks. Sutures were removed 10 to 14 days after the procedures. All patients received oral hygiene instruction and prophylaxis 3 and 6 months after the surgery (Figure 1e).

Statistical Analyses

Descriptive statistics were expressed as mean ± standard deviation (SD) and percentages. Data normality was tested using the Shapiro-Wilk test. The GRD, PD, and CAL were assessed by one-way repeated measures analysis of variance (ANOVA); KTT, DH, and esthetic VAS were evaluated by a paired T-test. For non-normal distribution data (KTW), the Friedman test was used. A significance level of 0.05 was adopted.

Results

All patients completed the 6-month follow-up. The full-mouth visible plaque index and sulcus bleeding index scores were maintained < 20% at the follow-up, indicating a good standard of supragingival plaque control. The sites included in the study did not show visible plaque or BoP throughout the study period. Table 1 shows the initial, 3-month, and final mean values for all clinical parameters assessed. Table 2 shows the changes in clinical outcomes over time. After 6 months, all the sites showed a statistically significant reduction in GRD, significant CAL gain, and no statistically significant differences in the PD. The mean gingival recession reduction (RecRed) value was 2.2 ± 0.6 mm, and the mean root coverage was 65.3 ± 22.0%. Two sites (20%) exhibited complete root coverage (CRC). In the present sample, there were no statistically significant differences in the mean value KTW after 6 months. The KTT presented a gain of 0.3 ± 0.4 mm; however, it was not statistically significant compared with the baseline. All sites showed statistically significant DH reduction at the end of the study (range 4.5 ± 3.7). Patient-centered esthetic evaluation (VAS) increased from 4.6 ± 2.4 to 9.5 ± 1.3 (p = 0.04). The professional evaluation (RES) mean value was 6.9 ± 1.3.

Discussion

This case series aimed to assess the outcomes of the XDM in the treatment of single GR RT1 by the CAF technique (de Sanctis and Zuccheli, 2007). Based on root coverage evaluation, it is suggested that this approach might be used for this purpose. Recent studies carried out on single and multiple GR have shown that, although the use of CTG still presents better outcomes, the use of XDM is also effective in terms of root coverage (Cieślik-Wegemund *et al.,* 2016; Gürlek *et al.,* 2020; Pietruska *et al.*, 2019; Suzuki *et al.,* 2020). Nevertheless, the XDM literature still lacks comparative information regarding the clinical efficacy of XDM in association with CAF procedures on single GR.

The mean RecRed (2.2 ± 0.6 mm) and mean root coverage (65.3 ± 22.0%) reached in this case series corroborate those of a recent study assessing the XDM and CTG efficacy in the treatment of single GR (Suzuki *et al.,* 2020). After a 6-month evaluation, Suzuki *et al.* (2020) reported a mean RecRed of 2.09 ± 1.01 mm and a mean root coverage of 61.33 ± 29.28% in the group treated with XDM, and they concluded that this new matrix could be used as an alternative to the CTG. Both were associated with an extended CAF (eCAF)

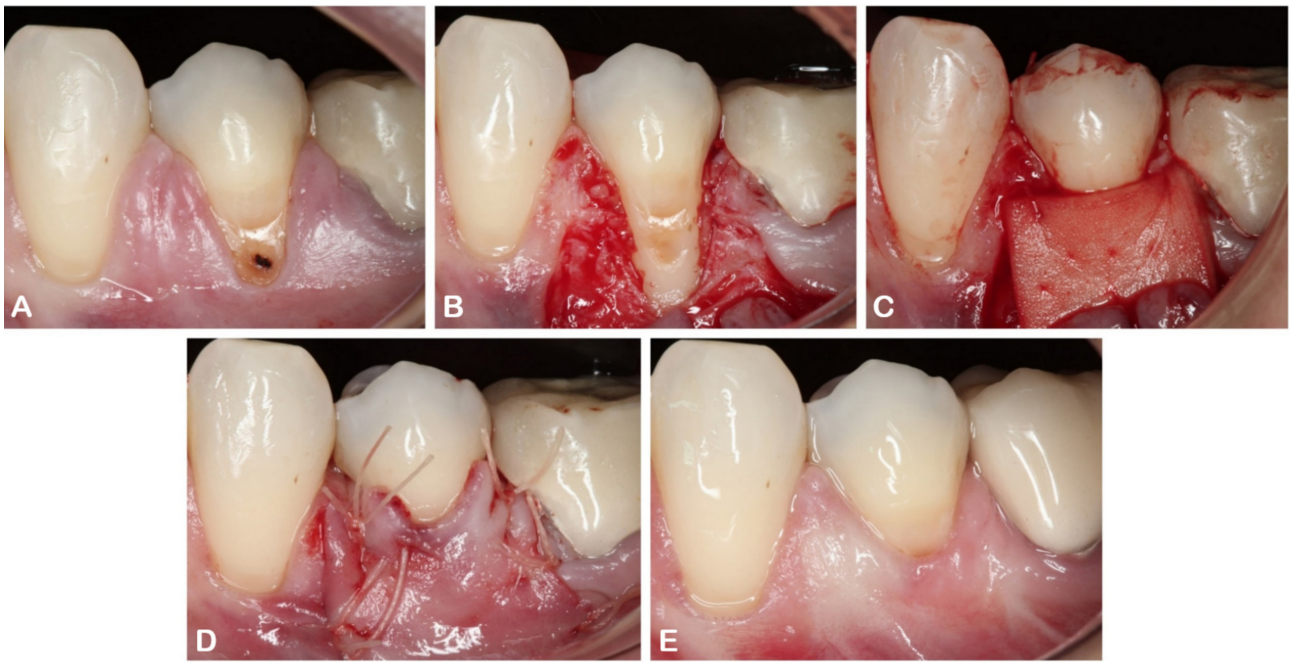

Figure 1. Representative clinical case of study: (A) baseline view; (B) after flap preparation and root decay removal; (C) xenogeneic acellular dermal matrix (XDM) in position and sutured on the adjacent papillae; (D) flap coronally positioned and sutured covering the graft and the recession defect; (E) root coverage at 6 months postoperatively.

Table 1. Clinical parameters (mean ± SD in mm) at baseline, 3 and 6 months (n=10).

		CAF+XDM	
	Baseline	3 months	6 months
Gingival recession depth (GRD)	3.5 ± 0.5a	1.1 ± 0.8b	1.2 ± 0.8b
Probing depth (PD)	1.1 ± 0.6a	1.3 ± 0.8a	1.2 ± 0.6a
Clinical attachment level (CAL)*	4.6 ± 0.9a	2.4 ± 1.4b	2.4 ± 1.3b
Keratinized tissue thickness (KTT)	1.1 ± 0.4a	-	1.4 ± 0.4a
Keratinized tissue width (KTW)	2.3 ± 1.3a	2.3 ± 1.2a	2.5 ± 1.0a
Dentin hypersensitivity (DH)*	5.6 ± 3.9a		1.1 ± 1.5b
Esthetics (VAS)*	4.6 ± 2.4a	-	9.5 ± 1.3b

Different lower-case letters: statistically significant difference between time points, p value <0.05 – One-Way Repeated Measures and post-hoc Bonferroni t-test.
* Different lower-case letters: statistically significant difference between time points, p value <0.05 – Paired T Test.

Table 2. Changes in clinical outcomes over time (n=10).

	CAF+XDM
RecRed (mm)	2.2 ± 0.6
Root coverage (%)	65.3 ± 22.0
Frequency CRC (N; %)	2; 20
KTT gain (mm)	0.3 ± 0.4
Esthetics (RES)	6.9 ± 1.3

RecRed, gingival recession reduction; CRC, complete root coverage; KTT, keratinized tissue thickness; RES, root coverage esthetic score.

technique (Barros *et al.*, 2004). Despite the surgical procedures performed in both studies being different, the data show similar results in terms of root covering when XDM is used to treat single GR, and the case series shows that the traditional trapezoidal flap can be used. Regarding other available studies in the literature, Gürlek *et al.* (2020) reported a similar mean RecRed (2.5 ± 0.95 mm) and a higher CRC rate (78%) after 6-months postoperative in multiple GR treated with XDM and a modified CAF (mCAF) technique (described by Zucchelli and De Sanctis, 2000). In a study comparing XDM and CTG associated with the TUN technique, Cieślik-Wegemund *et al.* (2016) demonstrated an inferior CRC (14.3%) compared with our results (20.0%). However, the mean root coverage was superior (91.0 ± 13.0%) in the same evaluation period. Nevertheless, the different GR types (single or multiple) and different techniques performed (CAF, mCAF, and TUN) make it impossible to compare the results accurately.

In a recent study, Cosgarea *et al.* (2020) compared the results of 1 year and 4 years after treatment of multiple GR using XDM associated with a modified TUN technique. Although a decrease in mean root coverage and CRC values was observed, the study demonstrated a favorable prognosis for this biomaterial after 4 years. The authors concluded that this approach is a valuable treatment option for the treatment of multiple GR RT1 and RT2. However, despite these good results, the literature still lacks information on the long-term prognosis for the treatment of single GR.

The increase of KTT may be a key factor to influence root coverage and to reduce the incidence of long-term GR recurrences (Jepsen *et al.,* 2013; Rebele *et al.,* 2014). In this case series, the KTT gain (0.3 ± 0.4 mm) was consistent with previous studies that also used XDM in the GR treatment. One similar study involving single GR reported a KTT gain of 0.29 ± 0.36 mm after 6 months from the eCAF + XDM procedure (Suzuki *et al.,* 2020). Another investigation demonstrated a KTT gain of 0.27 ± 0.40 mm on multiple GR treated with TUN + XDM at a 1-year assessment (Pietruska *et al.,* 2019). Although there were different approaches, the KTT gain seems to be similar in cases treated with XDM, being able to increase the KTT. Regarding KTW, the difference between the baseline and the final follow-up was not considered statistically significant in this case series. This result seems to be different from those obtained by Cieślik-Wegemund *et al.* (2016) and Pietruska *et al.* (2019), in which a statistically significant KTW increase was reported at 6-month and 1-year evaluations, respectively. However, the KTW values of the present study corroborate with the available literature, which shows that the use of a xenogeneic matrix (CM) does not promote significant KTW gain (Cairo *et al.,* 2014; Vignoletti *et al.,* 2015; Moreira *et al.,* 2016).

DH and aesthetic concerns are the main patient-factors associated with GR that motivate patients to request the root coverage treatment (Douglas de Oliveira DW *et al.,* 2013; Stefanini *et al.,* 2018). The evaluation showed significant DH reduction at 6-months after

the CAF + XDM procedure. Despite its importance, the available evidence on this parameter is limited. The aesthetic outcomes were evaluated from patient and professional standpoints. The results showed improvement in aesthetics at the end of follow-up, corroborating with other studies that reported improvement in aesthetic conditions after different surgical root coverage approaches (Zucchelli and De Sanctis, 2000; Santamaria *et al.,* 2017b). Regarding the RES evaluation, there is still scarce comparative available information for single GR treated with XDM. Nevertheless, the mean RES value observed at 6 months (6.9 ± 1.3) was similar to the mean RES value (7.06 ± 1.39) reported by Suzuki *et al.* (2020) after the same evaluation period on GR treated with eCAF + XDM procedures. Moreover, this mean the RES value was similar to that of another study (RES value = 7.11 ± 1.95), which assessed multiple GR treated with TUN + XDM after 1-year postoperative (Pietruska *et al.,* 2019). These data demonstrate that, although there is variability among different investigators and techniques from each study, the aesthetic results seem to be similar and satisfactory in cases of GR treated with XDM.

Based on the findings of this study, the use of the XDM associated with the CAF technique should be considered as a treatment option for single GR. However, some limitations of the present case series should be pointed out. It did not compare this treatment to other treatment options, and further randomized clinical trials have to be carried out to compare the efficacy and efficiency of this material. Moreover, the different techniques observed in the literature suggest the need for further evaluations regarding the most favorable root coverage surgical technique associated with XDM; therefore, randomized clinical trials are required to evaluate the best approach to use this biomaterial. Furthermore, the results in this study should be interpreted with caution once only canines and premolar were included and other tooth groups may present different results. Lastly, long-term studies are necessary to determine the stability outcomes of this approach.

Conclusion

Within the limitations of this study, it can be concluded that the XDM associated with the CAF technique presented satisfactory results in terms of root coverage and patient-centered parameters after 6-months.

Conflict of Interest and Source of Funding Statement

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