

Creeping attachment following treatment of multiple gingival recession defects with xenogeneic collagen matrix: Two case reports

Jonathan Meza-Mauricio,¹ Lorenzo Tavelli,² Marlon Marx Hilariano Maximiano,¹ Ilton José Mafra,¹ Javier Parma Garcia and Marcelo Faveri¹

¹Department of Periodontology, Dental Research Division, Guarulhos University, Guarulhos, SP, Brazil; ²Department of Periodontics and Oral Medicine, School of Dentistry, University of Michigan, Ann Arbor, MI, USA

Abstract

Aim: The aim of this report was to describe the phenomenon of creeping attachment that occurred following the use of a new xenogenic collagen matrix (CMX) for the treatment of multiple recession defects in the aesthetic region.

Methods: Two patients with multiple gingival recession defects were treated with coronally advanced flap technique plus CMX (Mucoderm®).

Results: Three months after grafting, the amount of root coverage obtained was partial. After a 2-year period, the previously denuded root surfaces were entirely covered by soft tissue.

Conclusions: The new CMX combined with the coronally advanced flap technique can lead to satisfactory root coverage of multiple Cairo type I recession defects which in some cases may be due to creeping attachment. However, further clinical studies with long-term outcomes must be conducted to evaluate the stability of the outcomes obtained with CMX in the long-term.

Keywords: *Gingival recession, collagen matrix, periodontal surgery, creeping attachment*

Introduction

Gingival recession is characterized by a pathological apical shift of the gingival margin, consequently exposing the root surface (Jepsen *et al.*, 2018). It has been suggested that possible etiological factors for this condition include orthodontic care, hard toothbrushing, surgical procedures, lack of keratinized tissue, and routine scaling and root planing. Gingival recession affects a large part of population, regardless of the standard of oral hygiene (Gorman *et al.*, 1967; Serino *et al.*, 1994). Many patients manifest recession defects and often desire therapy to eliminate esthetic concerns, especially in the maxillary anterior segment of the mouth (Changi *et al.*, 2020). Successful treatment of multiple adjacent gingival recession defects still represents a

challenge for the clinician, considering the need to coverage of a wider and more extensive surface, with different recession depths and recession widths or tooth position (Cosgarea *et al.*, 2016). The use of coronally advanced flaps has been shown to be an effective therapeutic approach for the treatment of multiple gingival recession defects, in particular when combined with a connective tissue graft (Ahmedbeyli *et al.*, 2019; Zucchelli *et al.*, 2000). In a recent systematic review, connective tissue graft-based procedures together with coronally advanced flaps demonstrated the best clinical outcomes in terms of superior percentages of mean and complete root coverage when compared with other root coverage procedures in the treatment of multiple gingival recession defects (Chambrone *et al.*, 2015).

Nevertheless, several drawbacks have also been associated with harvesting a connective tissue graft, such as patient morbidity, prolonged intra and post-operative bleeding, palatal sensory dysfunction, infection and an increased surgical time (Tavelli *et al.*, 2019a; Buff *et al.*,

Correspondence to: Marcelo Faveri, Centro de Pós-Graduação e Pesquisa-CEPPE, Universidade Guarulhos, Praça Tereza Cristina, 229 Centro, 07023-070 Guarulhos, SP, Brazil.
Email: mdfaveri@uol.com.br

2009). In an effort to avoid harvesting graft material from the palate, the use of xenogenic collagen matrices (CMXs) could be considered a valid option for the treatment of gingival recession defects with the aim of reducing patient morbidity (no donor site is required) (Tavelli *et al.*, 2020).

The use of CMX in the treatment of gingival recession defects has shown promising clinical outcomes, and it is considered a valid alternative to the connective tissue graft when the reduction of patient morbidity is the primary goal of the therapy (Ahmedbeyli *et al.*, 2019; Tavelli *et al.*, 2019b; Tonetti *et al.*, 2018; Cardaropoli *et al.*, 2012).

Creeping attachment refers to the coronal migration of the gingival margin after a mucogingival surgery in a coronal direction over portions of a previously denuded root. This phenomenon has been reported by several clinicians in the treatment of gingival recession by using autologous grafts and is apparently best observed on mandibular anterior teeth with narrow recession defects (Matter *et al.*, 1976; Matter *et al.*, 1980; Bell *et al.*, 1978) and normally can be detected between 1 to 12 months after autologous graft procedures with average coverage of about 1 mm (Bell *et al.*, 1978). This phenomenon is more likely to occur in younger patients, and when the recession is only on a single root. Additionally, the tooth position and the oral hygiene of the patient can be possible factors in creeping attachment (Matter *et al.*, 1976). However, the exact mechanism and biological events that lead to creeping attachment are still unknown (Changi *et al.*, 2020).

The literature is limited concerning creeping attachment in the treatment of gingival recession by using CMX combined with coronally advanced flaps. Two clinical studies reported this phenomenon using acellular dermal matrix (ADM) to aid root coverage. In a case report (Santos *et al.*, 2011) found that after a 10-year follow-up there was 2 mm gain of creeping clinical attachment when acellular dermal matrix was used. Similar phenomena were also reported by Changi *et al.*, 2020. On the other hand, creeping attachment was also reported

following the use of dermal matrix allograft material by (Haeri *et al.*, 2000) and their findings were comparable to the free gingival graft.

Currently, there is limited evidence whether creeping attachment should be expected from root coverage using CMX. Therefore, the aim of this article was to describe the use of a new CMX in the treatment of multiple gingival recession defects in the aesthetic region with 2 years of follow-up, highlighting the phenomenon of creeping attachment observed over time.

Consent statement

Both patients provided informed consent for the publication of this case report and accompanying images. These clinical cases followed the CARE statement for description of clinical cases (Riley *et al.*, 2017).

Pre-treatment

The patients received oral hygiene instruction to correct any traumatic tooth brushing habit that could be related to the etiology of the recession, at least 4 weeks before surgery. A pre-surgical supragingival scaling procedure was carried out with an ultrasonic device (Cavitron Select, Dentsply International Inc., Long Island City, NY, USA) and dental prophylaxis/polishing was performed 2 weeks before the scheduled surgical procedure.

Case 1

Patient information and Diagnostic assessment

A 35 year old female with multiple gingival recession defects in the 13, 11, 21 and 23 teeth presented to the periodontology clinic at Guarulhos University in 2017, reporting high sensitivity in the anterior teeth and a longer crown aspect compared to the adjacent teeth (Figure 1A). The patient had no systemic problems and was a non-smoker. She reported brushing three times a

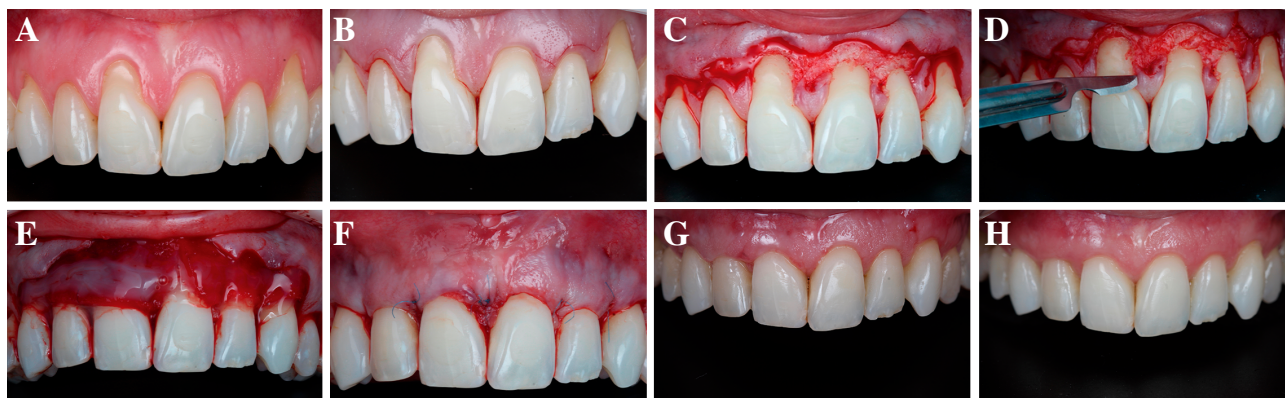


Figure 1. A) Multiple anterior gingival recession defects in anterior maxilla; B) Modified envelope flap; C) A tension free flap has been elevated; D) De-epithelialization of the anatomic papilla; E) Collagen matrix and enamel matrix derivative has been placed on the root surfaces; F) Sling mattress suture; G) Three months postoperative; H) Two-year follow-up.

day. Her oral hygiene was good, and the gingival tissues were healthy. Based on the Cairo classification, (Cairo *et al.*, 2011) the recession defects were classified as type I. Recession depth and clinical attachment level were recorded before the surgery (baseline), 3 months and 2 years after mucogingival surgery (Table 1).

Table 1. Clinical parameters at baseline, 3 months and 2 year

Follow-up		tooth			
		13	11	21	23
CAL	Baseline	4	4	3	5
	3 months	2	2	3	3
	2 years	1	1	1	1
RD	Baseline	2	3	1	3
	3 months	0	1	1	1
	2 years	0	0	0	0

CAL- clinical attachment level; RD- recession depth

Therapeutic intervention

The surgical procedure was performed by one trained and skilled periodontist (MF). After local anesthesia (Articaine with 1:100,000 epinephrine, DFL, Rio de Janeiro, RJ, Brazil), a horizontal incision was made with a scalpel to design a modified envelope flap (Zucchelli *et al.*, 2000). was performed, that connected a interdental area to the resection defect, finishing with a intrasutural incision (Figure 1B). The envelope flap was raised with a split-full- split approach in the coronal-apical direction (Figure 1C). Finally, the anatomic interdental papilla was de-epithelialized and root surfaces were mechanically treated with the use of curettes (Figure 1D). A collagen matrix (Mucoderm®) was cut to achieve proper shape and size to cover the entire root surface and surrounding bone and was positioned at the level of cemento-enamel junction, with a 10 min prior hydration with saline solution. Enamel matrix derivative (Emdogain®) was placed on the root surface and on the matrix (Figure 1E). The collagen matrix was sutured with sling sutures (6.0 Vicryl®, Johnson & Johnson, and Skillman, NJ, USA).

The flap was then positioned coronally and sutured with sling sutures so as to completely cover the matrix (Figure 1F).

Case 2

Patient information and Diagnostic assessment

A 45 years old male with bilateral multiple gingival recession defects in his maxillary anterior sextant presented to the periodontology clinic at Guarulhos University in 2017, reporting high sensitivity in the anterior teeth (Figure 2a). He reported brushing three times a day. His oral hygiene was good and the gingival tissue were healthy. Based on the Cairo classification (Cairo *et al.*, 2011), the recession defects were classified as type I. Recession depth and clinical attachment level were recorded before the surgery (baseline), 3 months and 2 years after mucogingival surgery (Table 2).

Therapeutic intervention

The surgical procedure was performed by the same periodontist (MF). After local anesthesia (Articaine with 1:100,000 epinephrine, DFL, Rio de Janeiro, RJ, Brazil), Both sides were treated with a modified envelope flap previously described (Zucchelli *et al.*, 2000). In the right side a connective tissue graft was used. The graft was harvested from the palate using double blade 1.5 mm technique described by (Harris *et al.*, 1992), while the left side was treated with CMX (Mucoderm®) and was used according to the manufacturer's recommendations (Pietruska *et al.*, 2019). The matrix was sutured with sling sutures (6.0 Vicryl®, Johnson & Johnson, and Skillman, NJ, USA). The flap was then positioned coronally and sutured with sling sutures so as to completely cover the matrix (Figure 2b).

Post-surgical care

The patients were instructed to abstain from brushing and flossing their teeth in the treated area until suture remove and consume only a soft diet during the first week. Patients were also instructed to rinse their mouth with 0.12% chlorhexidine digluconate solution (Periogard, São Paulo, SP, Brazil) for use twice a day for 14 days. An analgesic (ibuprofen 400 mg, as needed) was prescribed. Suture removal was done 2 weeks after surgery.

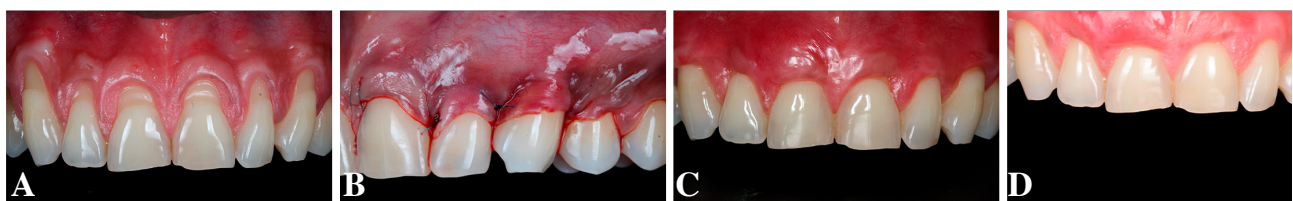


Figure 2. A) Multiple anterior gingival recession defects in anterior maxilla; B) Sling mattress suture; C) Three months postoperative, incomplete root coverage; D) two-year postoperative, complete root coverage.

Table 2. Clinical parameters at baseline, 3 months and 2 year

	Tooth	CTG				MD	
		11	12	13	21	22	23
CAL	Baseline	5	5	7	4	5	4
	3 months	3	2	3	2	2	3
	2 years	2	2	3	2	2	1
RD	Baseline	3	3	5	3	4	3
	3 months	0	0	0	1	1	1
	2 year	0	0	0	0	0	0

CAL- clinical attachment level; RD- recession depth

Results

At 3-months post-treatment, both patients reported satisfaction with the esthetic and functional outcomes achieved (Figures 1G, 2C). At the 2-year recall, the clinical and esthetic outcomes obtained in the short-term were found to be improved by creeping attachment. All gingival recession defects showed complete root coverage at 24 months, with the patients reporting satisfaction with a pleasant smile being achieved at the medium/long-term period post treatment times (Figures 1H, 2D). Additionally, dental hypersensitivity was no longer reported. Interestingly, in the clinical case #2, at 3 months post-surgery, complete root coverage was observed in the side treated with a connective tissue graft. On the other hand, in the side treated with CMX incomplete root coverage was observed on teeth 21, 22 and 23 after 3 months (Figure 2C). However, at the 2-year post operative time point, complete root coverage was noticed in both sided with a good esthetic result, confirming that creeping clinical attachment occurred on the teeth treated with coronally advanced flaps and CMX (Figures. 1H, 2D).

Discussion

The treatment of gingival recession has become a therapeutic issue of importance due to the increasing number of aesthetic requests from patients. Dental hypersensitivity and the prevention of caries and non-carious cervical lesions are other indications for root coverage surgical procedures (Cieslik *et al.*, 2016). Clinical and preclinical studies have reported the successful use of various collagen matrices for root coverage and soft tissue thickening procedures (Tonetti *et al.*, 2018; Jepsen *et al.*, 2013; Sculean *et al.*, 2015). The present case reports evaluated the treatment of maxillary Cairo type I multiple gingival recession defects by means of coronally advanced flaps in combination with a new CMX.

In the two cases presented in this report, we achieved approximately 90-95% of root coverage at 3 months

post-therapy and better outcomes were observed at 2 years after treatment, achieving 100% of root coverage of all teeth involved in our treatment. In addition, in clinical case #2 no differences were observed between connective tissue graft and CMX treatments. Both clinical cases showed a good stability of gingival margin in a long-term follow up. A recent network meta-analysis concluded that a connective tissue graft is the best treatment in terms of stability of the gingival margin over time (Tavelli *et al.*, 2019c). Nevertheless, it has to be mentioned that most of the data available in the literature regarding root coverage procedure with CMX report the outcomes of a first generation of collagen matrices. In our study a newer form of CMX was used and this may explain the creeping attachment observed at 2 years.

The mean root coverage observed in our study is in agreement with other published studies. Clinical studies evaluating the use of CMX, in the treatment of Miller's Class I and II gingival recession defects in the maxilla using a tunnel technique have reported a mean root coverage ranging from 73.2% to 84.3% at 12 months of follow-up (Cosgarea *et al.*, 2016; Pietruska *et al.*, 2019; Vincent *et al.*, 2017). In addition, a recent clinical study testing the new CMX plus coronally advanced flaps in comparison with a connective tissue graft in localized gingival recession found that both approaches resulted in significant recession depth reduction (mean root coverage of 61.33% for CMX and 73.90% for connective tissue graft) with no statistically significant differences noted between the two groups (Suzuki *et al.*, 2020).

In our cases we detected an improvement in our clinical outcomes between 3 months to 2 years of follow up, which was probably due to the creeping attachment. In both cases, creeping clinical attachment started 3 months after surgery and continued to reduce the distance from the cemento-enamel junction to the free gingival margin to 0 to 1 mm in some teeth up to 2-years. These amounts of creeping clinical attachment are similar to what was reported previously after using

acellular dermal matrix (ADM) to aid root coverage (Changi *et al.*, 2020; Santos *et al.*, 2011). For example, Santos *et al.*, (2011) found that after a 10-year follow-up there was 2 mm gain of creeping clinical attachment when acellular dermal matrix was used in combination with coronally advanced flaps. Similar phenomena were also reported by Changi *et al.*, (2020).

There are a number of published studies reporting creeping attachment in the treatment of gingival recession defects after using autologous grafts instead of using CMX combined with coronally advanced flaps (Matter *et al.*, 1976; Matter *et al.*, 1980; Bell *et al.*, 1978). Such creeping attachment may be attributed to the thickening of the soft tissue post-surgery seen in the CMX group. In a recent randomized clinical study, Suzuki *et al.*, (2020) did not find any difference in tissue thickness between CMX and connective tissue graft groups in the treatment of gingival recession defects. The average gains were 0.39 ± 0.4 mm for the CMX group in comparison to 0.51 ± 0.5 mm for the connective tissue graft group (Suzuki *et al.*, 2020).

Another explanation for the presence creeping attachment in these clinical cases was the use of enamel matrix derivative (EMD) during the root coverage procedure. In a recent study (França-Grohmann *et al.*, 2020) reported that the use of collagen matrix in combination of EMD may improve periodontal regeneration and this may contribute to our clinical outcomes. However, randomized clinical trials should be done in order to confirm the clinical results achieved by these clinical cases. Another important issue for clinical success is the identification and elimination of the causative agents of the recession (e.g. traumatic toothbrushing, periodontal disease, etc.) and also the compliance of the patients with regular periodontal maintenance (Chambrone *et al.*, 2015; Tatakis *et al.*, 2015).

Creeping attachment typically occurs within 1 to 12 months after the graft surgery (Bell *et al.*, 1978). However, creeping attachment may continue to progress beyond the first postoperative year. Even though it seems to occur whenever there has been an attempt to achieve root coverage with graft surgery, the amount of creeping attachment is unpredictable (Harris *et al.*, 1997). Therefore, a well-designed clinical trial, with careful observation of the clinical healing process of soft tissue grafts over the long term, is needed to identify factors that could play a significant role in this clinical finding. Such studies might ultimately elucidate the mechanism of creeping attachment.

Conclusion

The new CMX combined with coronally advanced flap technique could lead to satisfactory root coverage of multiple Cairo type I recession defects which in some cases may be due to creeping attachment. However,

further clinical studies with long-term outcomes must be conducted to evaluate the stability of the outcomes obtained with this new CMX in the long-term.

Acknowledgments

The authors declare that there are no conflicts of interests for any author in this manuscript.

References

- Ahmedbeyli C, Dirikan Ipçi S, Cakar G, Yılmaz S and Chambrone L. Coronally advanced flap and envelope type of flap plus acellular dermal matrix graft for the treatment of thin phenotype multiple recession defects. A randomized clinical trial. *Journal of Clinical Periodontology* 2019; **46**:1024–1029.
- Bell LA, Valluzzo TA, Garnick JJ and Pennel BM. The presence of “Creeping Attachment” in human gingiva. *Journal of Periodontology* 1978; **49**:513–517.
- Buff LR, Bürklin T, Eickholz P, Mönting JS and Ratka-Krüger P. Does harvesting connective tissue grafts from the palate cause persistent sensory dysfunction? A pilot study. *Quintessence International* 2009; **40**:479–489.
- Cairo F, Nieri M, Cincinelli S, Mervelt J and Pagliaro U. The interproximal clinical attachment level to classify gingival recessions and predict root coverage outcomes: an explorative and reliability study. *Journal of Clinical Periodontology* 2011; **38**:661–666.
- Cardaropoli D, Tamagnone L, Roffredo A and Gaveglio L. Treatment of gingival recession defects using coronally advanced flap with a porcine collagen matrix compared to coronally advanced flap with connective tissue graft: a randomized controlled clinical trial. *Journal of Periodontology* 2012; **83**: 321–328.
- Cieślak-Wegemund M, Wierucka-Młynarczyk B, Tanasiewicz M and Gilowski Ł. Tunnel technique with collagen matrix compared with connective tissue graft for treatment of periodontal recession: A randomized clinical trial. *Journal of Periodontology* 2016; **87**:1436–1443.
- Chambrone L and Tatakis DN. Periodontal soft tissue root coverage procedures: A systematic Review from the AAP Regeneration Workshop. *Journal of Periodontology* 2015; **86**:S8–51.
- Changi KK, Greenstein G, Tarnow D, Royzman D and Kang P. Creeping clinical Attachment after acellular dermal matrix augmentation to attain root coverage. *Clinical Advances in Periodontics* 2020; **10**: 75–80.
- Cosgarea R, Juncar R, Arweiler N, Lascu L and Sculean A. Clinical evaluation of a porcine acellular dermal matrix for the treatment of multiple adjacent class I, II, and III gingival recessions using the modified coronally advanced tunnel technique. *Quintessence International* 2016; **47**:739–747.

- França-Grohmann IL, Sangiorgio JPM, Bueno MR, *et al.* Treatment of dehiscence type defects with collagen matrix and/or enamel matrix derivative: Histomorphometric study in minipigs. *Journal of Periodontology* 2020.
- Goldman HM, Schluger S, Fox L and Cohen DW. *Periodontal Therapy*. 3rd. St. Louis, MO, USA: C. V. Mosby Co; 1964: 560.
- Gorman WJ. Prevalence and etiology of gingival recession. *Journal of Periodontology* 1967; **38**:316–322.
- Haeri A, Parsell D. Creeping attachment: Autogenous graft vs. dermal matrix allograft. *Compendium of Continuing Education in Dentistry* 2000; **21**:725–729.
- Harris RJ. The connective tissue and partial thickness double pedicle graft: A predictable method of obtaining root coverage. *Journal of Periodontology* 1992; **63**:477–486.
- Harris RJ. Creeping attachment associated with the connective tissue with partial-thickness double pedicle graft. *Journal of Periodontology* 1997; **68**:890–899.
- Jepsen K, Jepsen S, Zucchelli G, Stefanini M, *et al.* Treatment of gingival recession defects with a coronally advanced flap and a xenogeneic collagen matrix: A multicenter randomized clinical trial. *Journal of Clinical Periodontology* 2013; **40**:82–89.
- Jepsen S, Caton JG, Albandar JM, *et al.* Periodontal manifestations of systemic diseases and developmental and acquired conditions: Consensus report of workgroup 3 of the 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions. *Journal of Periodontology* 2018; **89**:S237–48.
- Matter J and Cimasoni G. Creeping attachment after free gingival grafts. *Journal of Periodontology* 1976; **47**:574–579.
- Matter J. Creeping attachment of free gingival grafts: A five-year follow-up study. *Journal of Periodontology* 1980; **51**:681–685.
- Pietruska M, Skurska A, Podlewski Ł, Milewski R and Pietruski J. Clinical evaluation of Miller class I and II recessions treatment with the use of modified coronally advanced tunnel technique with either collagen matrix or subepithelial connective tissue graft: A randomized clinical study. *Journal of Clinical Periodontology* 2019; **46**:86–95.
- Riley DS, Barber MS, Kienle GS, *et al.* CARE guidelines for case reports: explanation and elaboration document. *Journal of Clinical Epidemiology* 2017; **89**:218–235.
- Santos A, Goumenos G, Pascual A and Nart J. Creeping attachment after 10 years of treatment of a gingival recession with acellular dermal matrix: a case report. *Quintessence International* 2011; **42**:121–126.
- Sculean A, Mihatovic I, Shirakata Y, Bosshardt DD, Schwarz F and Iglhaut G. Healing of localized gingival recessions treated with coronally advanced flap alone or combined with either a resorbable collagen matrix or subepithelial connective tissue graft. A preclinical study. *Clinical Oral Investigation* 2015; **19**:903–909.
- Serino G, Wennström JL, Lindhe J and Eneroth L. The prevalence and distribution of gingival recession in subjects with a high standard of oral hygiene. *Journal of clinical Periodontology* 1994; **21**:57–63.
- Suzuki KT, de Jesus Hernandez Martinez C, Suemi MI, *et al.* Root coverage using coronally advanced flap with porcine-derived acellular dermal matrix or subepithelial connective tissue graft: a randomized controlled clinical trial. *Clinical Oral Investigation* 2020; **24**:1–12.
- Tatakis DN, Chambrone L, Allen EP, *et al.* Periodontal soft tissue root Coverage procedures: A consensus report From the AAP Regeneration Workshop. *Journal of Periodontology* 2015; **86**:S52–5.
- Tavelli L, Barootchi S, Ravidà A, Oh T-J and Wang H-L. What is the safety zone for palatal soft tissue graft harvesting based on the locations of the greater palatine artery and foramen? A systematic review. *Journal of Oral and Maxillofacial Surgery* 2019a; **77**:271.e1–271.
- Tavelli L, Barootchi S, Di Gianfilippo R, *et al.* Acellular dermal matrix and coronally advanced flap or tunnel technique in the treatment of multiple adjacent gingival recessions. A 12-year follow-up from a randomized clinical trial. *Journal of Clinical Periodontology* 2019b; **46**:937–948.
- Tavelli L, Barootchi S, Cairo F, Rasperini G, Shedden K and Wang HL. The effect of time on root coverage outcomes: A Network Meta-analysis. *Journal of Dental Research* 2019c; **98**:1195–1203.
- Tavelli L, McGuire MK, Zucchelli G, *et al.* Extracellular matrix-based scaffolding technologies for periodontal and peri-implant soft tissue regeneration. *Journal of Periodontology* 2020; **91**:17–25.
- Tonetti MS, Cortellini P, Pellegrini G, *et al.* Xenogenic collagen matrix or autologous connective tissue graft as adjunct to coronally advanced flaps for coverage of multiple adjacent gingival recession : Randomized trial assessing non-inferiority in root coverage and superiority in oral health. *Journal of Clinical Periodontology* 2018; **45**:78–88.
- Vincent-Bugnas S, Borie G and Charbit Y. Treatment of multiple maxillary adjacent class I and II gingival recessions with modified coronally advanced tunnel and a new xenogeneic acellular dermal matrix. *Journal of Esthetic and Restorative Dentistry* 2017; **30**:89–95.
- Zucchelli G and De Sanctis M. Treatment of multiple recession-type defects in patients with esthetic demands. *Journal of Periodontology* 2000; **71**:1506–1514.