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Treatment of deep single RT2 and RT3 antero-mandibular gingival recessions with a combination of surgical techniques: A case series study

A. Fernández-Jiménez PhD[1] | A. M. García-De-La-Fuente PhD[1] | X. Marichalar-Mendia PhD[2] | L. A. Aguirre-Zorzano PhD[1,3] | R. Estefanía-Fresco PhD[1,3]

[1]Research Group: GIU21/042, Department of Stomatology II, Faculty of Medicine and Nursing, University of the Basque Country (UPV/EHU), Leioa, Spain

[2]Research Group: GIU21/042, Department of Nursing I, Faculty of Medicine and Nursing, University of the Basque Country (UPV/EHU), Leioa, Spain

[3]Clínica Dr. Aguirre, Bilbao, Spain

Correspondence
A. M. García-De-La-Fuente, Department of Stomatology II, Faculty of Medicine and Nursing, University of the Basque Country (UPV/EHU), Barrio Sarriena s/n, 48940, Leioa, Bizkaia, Spain.
Email: anamaria.garciad@ehu.eus

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Abstract

Objective: To evaluate root coverage (RC) in deep single antero-mandibular RT2 and RT3 gingival recessions (GR) and to investigate the influence of several factors in RC.

Materials and Methods: Fifteen single antero-mandibular GR with a minimum depth of 3 mm were consecutively treated with a new one-stage technique (laterally positioned flap with a tunnel access and a connective tissue graft). At baseline and at 12-month follow-up, the percentage of mean root coverage (%MRC), the recession reduction (RecRed), complete root coverage (CRC) and the gain of keratinized tissue width (KTW) were assessed. Descriptive, intergroup comparative and correlation analyses were performed.

Results: At 12 months, a %MRC of 77.29 ± 21.48% with a mean RecRed of 4.10 ± 1.51 mm was achieved. The %MRC was 84.71 ± 21.08% in RT2, and 62.43 ± 14.17% in RT3. The mean gain of KTW was 2.10 ± 0.89 mm, with a mean gain of 2.0 ± 1.03 mm for RT2 and 2.3 ± 0.57 mm for RT3. CRC was observed in six cases, all of them being RT2. A positive association was found between the %MRC and the initial position of the tooth and of both papillae.

Conclusions: This technique might be a valuable approach for the treatment of deep single antero-mandibular RT2 and RT3 recessions, even in malpositioned teeth.

Clinical Significance: A combination of different surgical techniques could provide greater vascularization to the CTG especially in malpositioned teeth in sextant V with a large avascular area to be covered.

KEYWORDS
complete root coverage, gingival recessions, recession reduction, root coverage, RT2, RT3

A. Fernández-Jiménez, A. M. García-De La Fuente, L. A. Aguirre-Zorzano, and R. Estefanía-Fresco have contributed equally.

1 | INTRODUCTION

Gingival recessions (GR) are defined as the apical displacement of the gingival margin with respect to the cementoenamel junction (CEJ).[1] They are common and can affect all populations.[2,3] Their etiopathogenesis is multifactorial and complex, including predisposing and precipitating factors.[1]

The prevalence of GR is high, it increases with age,[2,4] and 80% of the general population would present them at buccal sites.[4,5] It has been reported that the patient-level prevalence of RT2 and RT3 GR was 88.8% and 55.0%, respectively, with the incisors and mandible being the locations with the highest risk of GR.[6] In fact, the prevalence of GR in mandibular incisors has been estimated to be 43%.[7]

Although untreated buccal GR tend to worsen over time,[8] studies on the treatment of single antero-inferior RT2/RT3 GR are scarce and limited to case series with different follow-ups (6–22 months)[9–11] and root coverage (RC) procedures,[9–11] in which the percentage of mean root coverage (%MRC) ranged from 74%[10] to 82%[11] and complete root coverage (CRC) between 14%[9] and 60%.[10]

These treatment results might be influenced by different factors, one of the most relevant being the type of recession. Although Miller's classification[12] has been widely used,[13] the use of a new classification[14] has been proposed, together with other parameters such as gingival thickness, keratinized tissue width (KTW) and the presence of a cervical step and of an identifiable CEJ.[1] However, the latter classification does not consider the initial tooth position (TP), which might negatively influence the achievement of RC, impairing the success of the treatment.[12,15] Based on current recommendations, GR that should be considered as Miller class III/IV[12] due to tooth malposition, would be diagnosed as RT1 if no loss of interproximal attachment was present,[14] thus, underestimating the difficulty of the case to be treated. Other factors that might affect RC would be the status of the interdental papilla, the depth of the vestibule and the prominence of the root, so treatment selection should be performed on an individual basis.[16,17]

Due to the scarce evidence regarding the treatment of deep single RT2/RT3 recessions in sextant V, a new technique is described in which three different procedures (a laterally positioned flap (LPF), a lateral tunnel (LT), and a connective tissue graft (CTG)) are combined, to improve the gain of keratinized gingiva and the vascularization for the underlying CTG, to obtain more predictable RC results.

The aim of this case series was to present the %MRC and the recession reduction (RecRed) at 12 months of follow-up in the treatment of deep single antero-mandibular RT2 and RT3 recessions with a new surgical approach. The secondary aim was to investigate the influence of several factors in RC.

2 | MATERIALS AND METHODS

2.1 | Study design and population

The protocol of this study was approved by the Ethics Committee of the University of the Basque Country (UPV/EHU) (CEISH/M10_2020_108), in accordance with the Helsinki declaration of 1975, as revised in 2013. Written informed consent was obtained from all patients. This clinical study has been reported according to the Preferred Reporting of Case Series in Surgery (PROCESS) guidelines.[18]

A total of 15 patients ($n = 2$ smokers) with deep single RT2 and RT3 GR located in the sextant V were consecutively treated with a combined technique in a one-stage procedure in this case series. The surgeries were performed from 2011 to 2021 in a private setting (*Clínica Dr. Aguirre*, Bilbao, Spain) affiliated with the UPV/EHU. The main outcome was the %MRC and the secondary objectives were to assess the CRC and the gain of KTW.

The included patients were adults (≥18 years) with one single buccal RT2/RT3 antero-mandibular recession >3 mm, who had been treated with a combined procedure (LPF, LT, and CTG). The exclusion criteria were as follows: (1) full-mouth plaque and bleeding scores >20%; (2) active periodontal disease; (3) intake of any medications known to affect gingival homeostasis or to interfere with wound healing; and (4) pregnancy and nursing women.

2.2 | Surgical procedure

All patients initially completed a plaque control program, including oral hygiene instructions[19] to correct habits related to the etiology of the GR,[20] as well as a presurgical prophylaxis. An experienced surgeon (LAAZ) designed this surgical procedure and performed all the surgeries under local anesthesia.

This one-stage procedure started as follows: after debridement and root planning of the exposed root, an intracrevicular incision was performed all along the soft tissue margin of the recession defect with a microsurgical blade (SM69®, Swann-Morton Ltd, UK). Then, an LPF was designed in the donor area, which was the closest proximal area to the recession where the greatest amount of keratinized tissue could be found. A horizontal incision was placed at least 3 mm away from the gingival margins of the adjacent teeth, with its mesio-distal extension being at least 6 mm longer than the recession width. It was followed by a vertical incision which was extended beyond the mucogingival junction, slightly inclined and ended with a cut-back preparation to enable the passive lateral mobilization of the flap. The LPF was then raised with a split-full approach in the coronal apical direction: a split dissection was performed until the bottom of the recession. This was followed by the full mobilization of the apical gingival tissues, and by the preparation of a tunnel in the other proximal side. In this area, the tunnel was extended to the adjacent tooth with specific tunneling instruments (Stoma®, Ancladen S.L., Barcelona, Spain), up to its farthest papilla, without mobilizing it (Figure 1A, B). Afterward, in the recession to be covered, both interdental papillae were de-epithelialized, followed by periosteal scoring and a deep apical split dissection, to eliminate frenulum and muscle tension.

A palatal CTG was harvested using the UPV/EHU technique[21] and placed into the previously prepared tunnel with a resorbable

FIGURE 1 Description of the laterally positioned flap, lateral tunnel and connective tissue graft combined technique; (A) baseline clinical and radiological situation of the RT3 recession in tooth 4.1, (B) preparation of the lateral pedicle, (C) placement of the CTG with the aid of a suture in the contralateral site, where a tunnel has been previously prepared, (D) stabilization of the CTG with a resorbable suture in the vascular bed of the pedicle, and (E) suture of the pedicle with a sling suture clamping the previously de-epithelialized papilla.

internal mattress suture (P.G.A. Rapid Arago®, Laboratorio Aragó SL, Barcelona, Spain) (Figure 1C). The other end of the CTG was fixed into the vertical incision with single interrupted sutures (Figure 1D).

The LPF was passively positioned over the CTG, being placed 1–2 mm coronal to the CEJ with a sling suture on the previously de-epithelialized papillae. Finally, primary closure was achieved with single interrupted sutures (Gore-Tex suture, W.L. Gore & Associates (UK), LTD, Scotland) (Figure 1E).

Post-operative measures included the administration of betamethasone acetate/betamethasone sodium phosphate (Celestone Cronodose IM®, Merck Sharp & Dohme S.A., Spain) 6 mg in a single-dose intramuscular injection the day of the surgery, diclofenac sodium (Voltaren®, Novartis Farmacéutica S.A., Spain) 50 mg every 8 h for 2 days, and amoxicillin/clavulanic acid (Augmentine®, GlaxoSmithKline S.A., Spain) 875/125 mg every 8 h for 7 days. Conventional oral hygiene techniques were interrupted in the surgical area for 15 days and 0.12% chlorhexidine digluconate mouthwashes were prescribed twice a day for 6 weeks. Also, local cold for 2 days and a soft diet and no physical exercise during the first week after the surgery were advised.

Sutures were removed from the palate and the recipient site 7 and 14 days after the surgery, respectively. Then, patients were instructed to resume oral hygiene, using an ultra-soft toothbrush and the Stillman technique[19] from the third to the sixth week after the surgery and their regular oral hygiene habits from then on. Patients were recalled at 1, 3, 6, and 12 months for intraoral evaluation and supragingival plaque control.

2.3 | Clinical and radiographic measurements

Information about age, sex, medical and dental history, medications, and social habits (tobacco and alcohol) was collected from the patient's clinical history. Clinical parameters were recorded from the periodontal charts at baseline and 12 months after treatment. All of them had been assessed with a standardized periodontal probe (PCP-11, Hu-Friedy, Mfg. Co. LLC, Chicago, USA) by the same experienced clinical examiner (REF). Thus, the following clinical parameters were collected: (1) probing depth (PD); distance in mm from the gingival margin to the bottom of the periodontal pocket); (2) gingival recession depth (GRD; distance in mm from the CEJ to the gingival margin); (3) width of the gingival recession (GRW; mesiodistal distance of the recession, measured in mm at the most

TABLE 1 Baseline characteristics of the treated recessions and by recession type.

Baseline characteristics	Total ($n = 15$)	RT2 ($n = 10$)	RT3 ($n = 5$)	Intergroup p
Recession (mm)				
Depth	5.47 (1.55) [3–9]	5.30 (1.70) [3–9]	5.80 (1.30) [4–7]	0.44
Width	3.37 (0.99) [2–5]	3.40 (0.99) [2–4.50]	3.30 (1.10) [2–5]	0.95
Keratinized tissue width				
Presence (%)	40 (n = 6)	40 (n = 4)	40 (n = 2)	>0.05
mm	0.47 (0.64) [0–2]	0.40 (0.52) [0–1]	0.60 (0.89) [0–2]	0.86
Phenotype (%)				
Thick	66.70 (n = 10)	60 (n = 6)	80 (n = 4)	0.43
Thin	33.30 (n = 5)	40 (n = 4)	20 (n = 1)	
Presence of papilla (%)				
Mesial	26.70 (n = 4)	40 (n = 4)	0 (n = 0)	0.30
Distal	46.7 (n = 7)	70 (n = 7)	0 (n = 0)	**0.004**
Both	20 (n = 3)	30 (n = 3)	0 (n = 0)	0.095
CEJ (%)				
Class A (detectable)	53.30 (n = 8)	50 (n = 5)	60 (n = 3)	0.71
Class B (undetectable)	46.7 (n = 7)	50 (n = 5)	40 (n = 2)	
Location of the recession (%)				
4.1	53.39 (n = 8)	40 (n = 4)	80 (n = 4)	0.38
3.1	20 (n = 3)	20 (n = 2)	20 (n = 1)	
3.2	13.30 (n = 2)	20 (n = 2)	0 (n = 0)	
4.3	6.70 (n = 1)	10 (n = 1)	0 (n = 0)	
3.3	6.70 (n = 1)	10 (n = 1)	0 (n = 0)	
Tooth position (%)				
Correct/optimum	6.7 (n = 1)	0 (n = 0)	20 (n = 1)	0.38
Rotated	6.7 (n = 1)	10 (n = 1)	0 (n = 0)	
Vestibularized	46.7 (n = 7)	50 (n = 5)	40 (n = 2)	
Rotated + vestibularized	40 (n = 6)	40 (n = 4)	40 (n = 2)	
Other characteristics (%)				
Diastema	6.7 (n = 1)	10 (n = 1)	0 (n = 0)	0.28
Root resorption	6.7 (n = 1)	0 (n = 0)	20 (n = 1)	
Two previous grafts	6.7 (n = 1)	10 (n = 1)	0 (n = 0)	
Rx distance from CEJ to bone (mm): mean, (standard deviation), [range]				
Mesial	4.40 (2.09) [1.70–8.70]	3.34 (1.16) [1.70–5.30]	6.54 (1.92) [3.80–8.70]	**0.005**
Distal	3.23 (1.27) [2–6]	2.65 (0.69) [2–3.90]	4.40 (1.42) [3.10–6]	**0.019**

Note: Recession (depth and width), Keratinized tissue width and Rx distance from CEJ to bone measured in millimeters are shown as mean, (standard deviation), and [range]. The results of this study were considered statistically significant when $p < 0.05$.
Abbreviations: CEJ, cementoenamel junction; Rx, radiographic.

coronal point); (4) clinical attachment loss (CAL; distance in mm from the CEJ to the bottom of the gingival sulcus, calculated as the sum of GRD and PD); (5) width of the keratinized tissue (KTW; distance in mm from the mucogingival junction to the gingival margin, measured in the mid-buccal site).

The following parameters were recorded only at baseline: (1) the presence of a mesial and distal papilla completely filling the interdental space (yes or no); (2) the gingival phenotype, determined by placing the probe into the facial sulcus, assessing its visibility through the gingiva (thin: ≤1.0 mm or thick: >1 mm)[22]; (3) the

TABLE 2 Clinical outcomes at 12-month follow-up.

	Mean GRD (mm) (SD) [range]			MRC (T1) (mm) (SD) [range]		CRC (%) (n) (T1)	Mean KTW (mm) (SD) [range]			Mean KTG (mm) (SD) [range] (T1)
	T0	T1	*p* Intragrupe	mm	%		T0	T1	*p* Intragrupe	
Total (n = 15)	5.47 (1.55) [3–9]	1.37 (1.39) [0–3.50]	**<0.001**	4.10 (1.51) [3–9]	77.29 (21.48) [50–100]	40% (6)	0.47 (0.64) [0–2]	2.57 (0.82) [1–4]	**<0.001**	2.10 (0.89) [0.50–4]
RT2 (*n* = 10)	5.30 (1.70) [3–9]	0.90 (1.29) [0–3]	**0.005**	4.40 (1.78) [3–9]	84.71 (21.08) [50–100]	60% (6)	0.40 (0.52) [0–1]	2.40 (0.88) [1–4]	**0.005**	2 (1.03) [0.50–4]
RT3 (*n* = 5)	5.80 (1.30) [4–7]	2.30 (1.20) [1–3.50]	**0.04**	3.50 (0.50) [3–4]	62.43 (14.17) [50–80]	0% (0)	0.60 (0.89) [0–2]	2.90 (0.65) [2–3.50]	**0.042**	2.30 (0.57) [1.50–3]
p Intergrupe	0.44	0.06		0.31	0.055	**0.04**	0.86	0.25		0.44

Note: The results of this study were considered statistically significant when $p < 0.05$.

Abbreviations: CRC, complete root coverage; GRD, gingival recession defect; KTG, keratinized tissue gain; KTW, keratinized tissue width; mm, millimeters; MRC, mean root coverage; SD, standard deviation.

TP (optimum position = the tooth was in its ideal position in the arch, in line with the adjacent teeth; rotated = the tooth was in its ideal position in the arch but the crown's facial aspect was turned towards the mesial or the distal; vestibular displacement = the tooth was out of the line with respect to the adjacent teeth, towards the vestibular; the combination of rotation and vestibular displacement), (4) the presence/absence of the CEJ[23]; if the CEJ was not detectable, it was determined by considering the interdental CEJ, which was easily identified by elevating the interdental soft tissue with a probe[24]; (5) the presence/absence of a cervical step[23]; and (6) the radiographic bone distance between the CEJ and the alveolar crest in both mesial (MRxD) and distal (DRxD) locations. For this purpose, all baseline periapical radiographs, that had been taken using the parallel technique,[25] were scanned with VISTAScan® (Dürr Dental SE, Bietigheim-Bissingen, Germany), and then were calibrated and measured with the ImageJ® software.[26] The reproducibility of the examiner (AFJ) was assessed by measuring four periapical radiographs, not included in the study, twice, with a separation of at least 24 h. An intraclass correlation coefficient >0.75 was accepted.

Finally, at the 12-month follow-up, the %MRC (mean preoperative GRD—mean post-operative GRD/mean preoperative GRD × 100) was calculated, as well as the RecRed in millimeters (mean preoperative GRD—mean post-operative GRD). In addition, the secondary outcomes were the CRC (the number of GR in which GRD = 0 mm at 12-months), which was recorded to evaluate the percentage of CRC (%CRC) (CRC × 100/number of total recessions) and, also, the change in the KTW was assessed.

In order to compare the clinical data, the sample was divided into two groups (RT2 or RT3), according to the type of GR, following the most recent recommendations.[14]

2.4 | Statistical analysis

The statistical analysis was performed with the IBM SPSS® v.20 software (IBM, Chicago, IL, USA) by a blinded statistician (XMM). Descriptive statistics were expressed as mean and standard deviation and as percentages. Differences in the clinical results were analyzed using the Fisher's F exact test. Moreover, the possible relationship between the %MRC and the other variables was evaluated using the Spearman correlation coefficient, the Mann–Whitney *U* test or the Kruskal–Wallis test, according to the nature of the variable. Results were considered statistically significant when $p < 0.05$.

3 | RESULTS

Fifteen patients with a mean age of 38.40 ± 11.97 years (20–58), 86.7% females (RT2:80% vs. RT3:100%) and 13.33% heavy smokers, were consecutively included in this study. None of the included patients was identified as non-binary. Baseline characteristics of all the recessions are shown in Table 1. Of the 15 deep GR (RT3: $n = 5$),

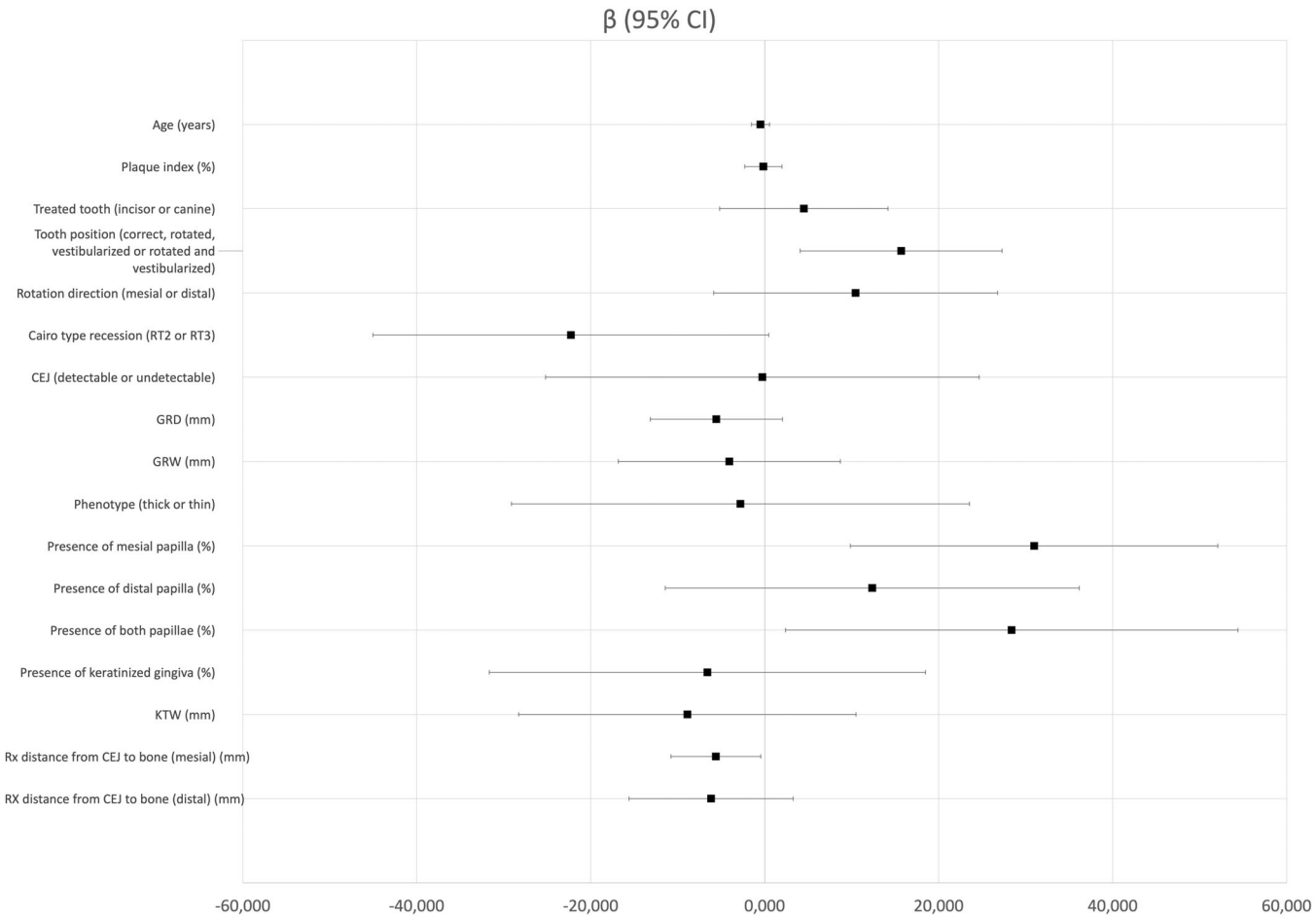

FIGURE 2 A forest plot graph of the logistic regression between the mean %RC and the other registered variables.

none had a cervical step, and 14 recessions were associated with tooth malposition. When comparing TP between RT2 and RT3 recessions, no statistically significant differences were observed (Table 1).

At baseline, the GRD was 5.47 ± 1.55 mm (3–9), the GRW was 3.37 ± 0.99 mm (2–5), and the mean KTW was 0.47 ± 0.64 mm (0–2). When analyzing both types of recessions, no statistically significant differences were observed between the groups.

The mean initial MRxD was 4.40 ± 2.09 mm (1.70–8.7) and DRxD was 3.29 ± 1.27 mm (2–6). Eight RT2 gingival recessions showed at least one complete interdental papilla. Specifically, three patients had complete papillae in both mesial and distal locations, while one and four patients presented a complete papilla only in the mesial or distal location, respectively. When comparing RT2 and RT3 groups, statistically significant differences were seen for MRxD ($p = 0.005$), DRxD ($p = 0.019$) and the presence of the distal papilla ($p = 0.004$) (Table 1).

Data about the %MRC, RecRed, CRC and gain of KTW are shown in Table 2. A statistically significant change between baseline and 12 months was observed for all variables. At 12 months, the %MRC was 77.29 ± 21.48% ($p < 0.001$) [RT2: 84.71 ± 21.08% ($p = 0.005$)/RT3: 62.43 ± 14.17% ($p = 0.04$)], with a mean RecRed of 4.10 ± 1.51 mm (RT2: 4.40 ± 1.78 mm/RT3: 3.50 ± 0.50 mm). CRC was observed in 6 recessions (60%), all of them being RT2 ($p = 0.04$). The mean gain of KTW was 2.10 ± 0.89 mm ($p < 0.001$), achieving a mean gain of KTW of 2.0 ± 1.03 mm ($p = 0.005$) and 2.3 ± 0.57 mm ($p = 0.042$) for RT2 and RT3, respectively.

When analyzing which factors could influence the %MRC (Figure 2) a positive association was detected between the %MRC and the baseline TP ($\beta = 15.687$; CI95%: 4.083–27.291; $p < 0.012$), the presence of a complete mesial papilla ($\beta = 30.975$; CI95%: 9.852–52.097; $p < 0.007$) and of both papillae ($\beta = 28.393$; CI95%: 2.377–54.41; $p < 0.035$), while a negative association was found for the MRxD ($\beta = -5.612$; CI95%: −10.778 to −0.447; $p < 0.035$) (Table 3).

Clinical and radiographic characteristics of four (3 RT2 and 1 RT3) at baseline and 12 months after the surgical procedure are shown in Figure 3.

4 | DISCUSSION

In this study, 15 patients were treated with a new combined surgical approach consisting of a CTG inserted through a LT preparation and an LPF, achieving a %MRC of 78%. Of the 15 single GR located in sextant V, five were diagnosed as RT3, in which a final %MRC of 65%

TABLE 3 Logistic regression between the mean %RC and the other registered variables.

	%MRC	
Baseline characteristics	**β (95% CI)**	**p-Value**
Age (years)	−0.482 (−1.518 to 0.554)	0.333
Plaque index (%)	−0.156 (−2.282 to 1.971)	0.877
Treated tooth (incisor or canine)	4492 (−5.198 to 14.181)	0.335
Tooth position (correct, rotated, vestibularized or rotated and vestibularized)	15.687 (4.083 to 27.291)	**0.012**
Rotation direction (mesial or distal)	10.452 (−5.856 to 26.759)	0.189
Cairo type recession (RT2 or RT3)	−22.286 (−45.033 to 0.461)	0.054
CEJ (detectable or undetectable)	−0.267 (−25.19 to 24.656)	0.982
GRD (mm)	−5.556 (−13.15 to 2.037)	0.138
GRW (mm)	−4.062 (−16.827 to 8.703)	0.504
Phenotype (thick or thin)	−2.786 (−29.11 to 23.538)	0.823
Presence of mesial papilla (%)	30.975 (9.852–52.097)	**0.007**
Presence of distal papilla (%)	12.36 (−11.438 to 36.158)	0.282
Presence of both papillae (%)	28.393 (2.377–54.41)	**0.035**
Presence of keratinized gingiva (%)	−6.587 (−31.659 to 18.486)	0.58
KTW (mm)	−8.895 (−28.288–10.498)	0.34
Rx distance from CEJ to bone (mesial) (mm)	−5.612 (−10.778 to −0.447)	**0.035**
RX distance from CEJ to bone (distal) (mm)	−6.164 (−15.603 to 3.275)	0.182

Note: The results of this study were considered statistically significant when $p < 0.05$.

Abbreviations: %MRC, percentage of root coverage; CEJ, cementoenamel junction; CI, confidence interval; GRD, recession depth; GRW, recession width; KTW, keratinized tissue width; Rx, radiographic; β, β coefficient.

was observed. To the best of the authors' knowledge, this would be the first study in which the %MRC in single antero-mandibular RT3 recessions has been evaluated.

In fact, there are only a few studies addressing the treatment of single RT2 recessions,[9–11] and none has been performed in RT3. Thus, only the RT2 results of the present study can be compared with the current evidence.

After 12 months, the %MRC in RT2 was 85% (50%–100%), being slightly superior to previous studies which ranged from 75%[9] to 82%.[11] Nevertheless, in this study, the baseline GRD (5.30 mm) and the initial GRW (3.40 mm) were higher than those reported on previous studies.[9–11] Although the presence of a larger avascular area could limit the RC obtained,[14,27] our results could be explained by the technique itself, which was designed for the treatment of these specific recessions, allowing an increase in the vascularization to the underlying CTG. Anchoring the LPF on the de-epithelialized papillae allows its coronal displacement, covering and overlapping the CEJ to increase the probability of achieving a greater RC.[28,29] Also, starting the preparation of the mucoperiosteal tunnel from apical, close to the mucogingival junction and extending it towards coronal, would decrease the risk of perforation, especially in thin phenotypes, thus avoiding compromising the vascularization of the recipient bed. Moreover, the use of a CTG with a thickness >2 mm[30] would also be a key factor for success in the treatment of RT2 recessions, especially in this antero-mandibular region where the thickness of the gingival tissues usually is <1 mm.[31] In a study of 121 Miller class III recessions, with 57% of recessions treated in sextant V, it was reported that CRC was associated with a combination of several factors, such as interproximal soft tissue integrity, interproximal bone loss <3 mm and using a thick graft.[30] These grafts would allow us to modify the gingival phenotype,[32] increasing it and thus, facilitating the creeping attachment effect[13,32] and minimizing the risk of recurrences.[33] Hence, thicker grafts during the first phases of the tissues healing would favor the achievement of greater root coverage[30,34,35] which could contribute to a greater long-term stability.[36,37]

Regarding the %CRC in RT2 recessions, the present data were very similar to those of Sculean & Allen[10] (60%) and higher than the 14% obtained by Nart and Valles.[9] However, although achieving CRC would be the ideal outcome, this might not always be a realistic goal in these recessions.[13] Therefore, treatment should focus on improving the KTW to provide better mucogingival conditions for oral hygiene and to prevent the progression of the residual recession.

In fact, in those cases where the KTW is less than 2 mm, as in this study, the recommended therapeutic procedures would be the tunnel approach or the LPF, regardless of the gingival thickness.[16] By doing so, a KTW gain of 2.17 mm was obtained, which was similar to a previous study[9] (2.57 mm), despite being lower than that of Katti et al.[11] (3.9 mm), where the treatment consisted of a free gingival graft.

In the current study, the presence of malpositioned teeth (87%) was very high, and the presence of complete papillae was heterogeneous: as a matter of fact, both papillae were only observed in three recessions, in which CRC was obtained. It seems that the rotation of the tooth will influence the volume of both papillae impairing the result of the treatment, where the CRC achieved will be lower than expected.[15,38] This anatomical limitation must be considered in the treatment planning phase, especially in patients with high expectations, who should be informed that obtaining CRC is not predictable in these cases. In our study, a positive association was observed between the %MRC and the TP at baseline ($p < 0.012$), and with the presence of both papillae ($p < 0.035$). This association could be due to the described technique, which would have favored RC even in these wide and deep recessions in teeth with a marked tooth malposition.

Recently, in RT2 antero-mandibular GR, a combined therapeutic approach with a previous orthodontic treatment was proposed[39] to improve the clinical scenario. However, previous orthodontic

FIGURE 3 Baseline and 12-month clinical and radiological images of the two types of recessions (RT2 and RT3) treated with the combination of a laterally positioned flap, a lateral tunnel and a connective tissue graft.

treatment is not always accepted by the patients and, in these cases, only a surgical procedure would be possible. Therefore, this technique could be a valuable therapeutic choice in deep single RT2 and RT3 antero-mandibular recessions.

The present study has limitations, such as the lack of a comparative control group and not having recorded some other clinical variables, like the width of the bottom and the length of the papillae, the distance from the bottom of the papilla to the contact point and the vestibular depth. Also, related-sex/gender analysis was not performed, due to the majority of patients in both groups (RT2: 80% and RT3:100%) being women, and none of the patients identifying as non-binary. It is known that females are more demanding of oral health care,[40] so this finding was not surprising. However, this is the first case series where deep single antero-mandibular RT3 recessions have been assessed, and the results could be considered successful in terms of %MRC (62%), RecRed (3.50 mm), and gain of KTW (2.3 mm).

5 | CONCLUSIONS

The present results suggest that this one-stage technique, combining a laterally positioned flap, a tunnel approach and a connective tissue graft, might be a valuable therapy for the treatment of deep single antero-mandibular RT2 and RT3 recessions especially in rotated and/or vestibularized teeth where anatomical limitations could worsen the predictability of the treatment. Therefore, more studies with larger sample sizes and with long-term follow-ups are needed to know which individual characteristics at patient- and recession-level will determine achieving a higher RC.

AUTHOR CONTRIBUTIONS

Conceptualization: Luis Antonio Aguirre-Zorzano. *Methodology*: Aitziber Fernández-Jiménez, Ruth Estefanía-Fresco, Ana María García-De-La-Fuente and Luis Antonio Aguirre-Zorzano. *Data collection*: Aitziber Fernández-Jiménez and Ruth Estefanía-Fresco. *Formal analysis and investigation*: Aitziber Fernández-Jiménez, Ruth Estefanía-Fresco, Ana María García-De-La-Fuente and Xabier Marichalar-Mendia. *Writing-original draft preparation*: Aitziber Fernández-Jiménez, Ruth Estefanía-Fresco and Ana María García-De-La-Fuente. *Writing-review and editing*: Aitziber Fernández-Jiménez, Ruth Estefanía-Fresco and Ana María García-De-La-Fuente. *Supervision*: Luis Antonio Aguirre-Zorzano. *Approval of the manuscript*: Aitziber Fernández-Jiménez, Ana María García-De-La-Fuente, Luis Antonio Aguirre-Zorzano, Xabier Marichalar-Mendia and Ruth Estefanía-Fresco.

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CONFLICT OF INTEREST STATEMENT

The authors declare that they do not have any financial interest in the companies whose materials are included in this article.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

INFORMED CONSENT

Informed consent was obtained from all individual participants included in the study. The authors affirm that human research participants provided informed consent for publication of the images in Figures 1a–e and 2.

ORCID

A. Fernández-Jiménez https://orcid.org/0000-0002-6518-992X
A. M. García-De-La-Fuente https://orcid.org/0000-0003-4043-1449
X. Marichalar-Mendia https://orcid.org/0000-0001-5948-9443
L. A. Aguirre-Zorzano https://orcid.org/0000-0002-5805-9019
R. Estefanía-Fresco https://orcid.org/0000-0003-2287-1264

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