Clinical outcomes of root coverage with subepithelial connective tissue graft according to site specific factors – longitudinal retrospective clinical study

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Abstract

Objectives: This study investigated these possible correlations by a retrospective evaluation of patients with multiple GR treated with SCTG + CAF after 12 months postoperatively.

Methods: data were collected before surgery and at 6- and 12-month follow-up related to depth (RD) and width (RW) of GR, width (KTW) and thickness (KTT) of keratinized tissue, bone dehiscence (BD), vertical (VC) and horizontal (HC) coverage and sensitivity (SEN). Additionally, data on the technique employed, Miller classification of GR and location of GR were analyzed. The values were described as means and standard deviations, and the variations of parameters were assessed by ANOVA for repeated measures and Tukey test or paired t test. Comparison between periodontal and nominal variables was performed by the t test, and the relationship between periodontal parameters was assessed by the Pearson correlation test. A significance level of 5% ($p<0.05$) was adopted.

Results: The results indicated significant reduction in RD, RW and SEN values and increase in KTW between the initial period and 6 and 12 months, but not between 6 and 12 months. The KTT was increased in all periods analyzed. The VC was greater in the maxilla at 6 months, but with no significant difference between 6 to 12 months. The same relationship was observed for RD between GR class I and II. At 12 months, no difference was observed between root coverage techniques employed.

Conclusion: It may be concluded that several site-specific and technical factors influenced the middle- and long-term results of root coverage in multiple GR.

Key words: Gingival recession, dentin sensitivity, autografts, periodontics

Introduction

Gingival recession (GR) is defined as positioning of the gingival margin apically to the cementoenamel junction, leading to root exposure and consequently esthetic problems and hypersensitivity (Chambrone and Tatakis, 2016). This condition is highly prevalent in both healthy and periodontally compromised patients (Gorman, 1967; Susin *et al.*, 2004; Thomson *et al.*, 2006; Richmond *et al.*, 2007; Dominiak and Gedrange, 2014). Several techniques have been designed for root coverage of multiple or isolated gingival recessions, achieving satisfactory results (Cairo *et al.*, 2008; Chambrone *et al.*, 2008; Chambrone *et al.*, 2010). Among them, the coronally advanced flap (CAF) associated with subepithelial connective tissue graft (SCTG) is considered the gold standard treatment with higher percentage of root coverage (Chambrone *et al.*, 2010). The success of this procedure depends on site-specific factors of recipient sites, intrinsic factors of the individuals, and surgical technique employed (Richardson *et al.*, 2015). The fundamental anatomic characteristics used to analyze the predictability of root coverage are related to tooth location in the dental arch, presence or not of adjacent recessions, loss of proximal attachment,

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width and thickness of keratinized tissue apically or laterally to GR, vestibule depth and width/depth of GR (de Sanctis and Clementini, 2014).

Periodontal parameters used to evaluate the success of procedures with SCTG include: reduction of depth and width of recession, percentage of vertical and horizontal root coverage, complete root coverage and variation in width and thickness of keratinized tissue (Zucchelli *et al.*, 2010; Rebele *et al.*, 2014; Rotenberg and Tatakis, 2014). This retrospective study evaluated the correlation of different variables related to technique, anatomical sites, Miller classification (Miller, 1985) and variations in periodontal parameters in individuals with multiple gingival recession sites treated with SCTG with CAF at 6 and 12 months postoperatively.

Materials and methods

This longitudinal retrospective clinical study included individuals registered at the Periodontal Plastic Surgery Clinic of Bauru School of Dentistry (FOB-USP) between 2015 and 2018, with at least 12 months of postoperative follow-up. The experimental design of this study was approved by the Institutional Review Board of FOB-USP (CAAE: 49806015.8.0000.5417). The participants were provided detailed and written information on the treatments that would be performed and signed an informed consent form, authorizing the later utilization of data collected during their treatment.

The sample included individuals without systemic involvement that might influence on periodontal condition; aged 18 to 70 years; with clinical diagnosis of multiple GR Miller class I or II (Recession Type 1), with root surfaces without abrasion, erosion or caries; and without any contraindication for the periodontal surgical procedures. The study excluded smokers; pregnant or nursing women; with history of periodontal disease or recurrent formation of abscess; previously submitted to root coverage surgical procedures on the evaluated sites; using drugs with action on periodontal tissues; with plaque index and bleeding index >20%; and rotated, extruded, prominent or mobile teeth.

All selected patients were submitted to basic periodontal procedures (root scaling and planing, coronal polishing and oral hygiene instruction) and control of etiologic factors related with GR before the surgical procedures. The patients were maintained with strict plaque control during the follow-up, presenting plaque and bleeding indices ≤ 20% throughout the study period.

Surgical procedures

The patients included in the study were treated by the combination of SCTG and CAF. For that purpose, the techniques described by Zühr *et al.* (2007) and Zucchelli and De Sanctis (2000) were used, as indicated for each case. Briefly, in the technique of Zühr *et al.* (2007) (Figure 1A-1F), tunneling instruments (Hu-Friedy®, USA) were used to perform interconnected sulcular incisions in all teeth to be treated, maintaining the apical insertions in the papillae. These incisions extended in apical direction beyond the mucogingival junction, allowing tissue mobility in coronal direction. In cases in which the technique of Zucchelli and De Sanctis (2000) was applied (Figure 1G-1L), oblique incisions were performed from the CEJ to the base of the adjacent recession using a scalpel blade n. 15C (Swann-Morton®, UK), taking as reference the central recession and maintaining its direction in adjacent teeth to be treated. The interdental papilla was de-epithelialized with a scalpel blade, to assure blood supply to the surgical papilla after suture. A full-thickness flap was raised up to the mucogingival junction, to maintain the thickness of the displaced flap on the denuded root surface. In the most apical portion, the flap was divided to eliminate muscle tensions and allow greater mobility for subsequent flap accommodation coronally to the CEJ (Richardson *et al.*, 2015). Regardless of the technique employed, the root surfaces exposed to the oral environment were carefully scaled with periodontal curettes. The SCTG was obtained by one of the following two techniques: double blade (Harris, 1997) or de-epithelialized gingival graft, both with 1.5-mm thickness, according to the tissue availability at the donor site. The thickness of all grafts obtained was measured using an anesthetic needle with an endodontic stop on a digital caliper. The graft width was calculated according to the amount of tissue required to cover the exposed roots, constituted by the sum of recession widths plus 3 mm on the mesial and distal sides. The graft height was the distance from the CEJ to the buccal bone crest (Zucchelli *et al.*, 2010). The area of collection in all cases was delineated on the palatal region between the mesial surface of canine and distal surface of first molar, with preference to the premolar region. The incisions were also maintained at 2 mm from the gingival margins of teeth.

After rinsing the recipient site with saline, the SCTG was positioned on the exposed roots and sutured with nylon 5-0 (Ethicon®, USA) to the adjacent connective tissue at the CEJ level. Following this, the flap was coronally positioned. In all cases, the CEJ and SCTG were completely covered by soft tissue flap. The palatal sutures were removed after 7 days, and the recipient site after 14 days.

All patients were prescribed nimesulide 100mg (1 tablet at every 12 hours for 5 days), dipyrone 500mg (1 tablet at every 6 hours for 5 days) and 0.12% chlorhexidine digluconate mouthrinse (twice a day for 4 weeks). The patients received verbal and written instructions on the postoperative care. During this period, they were asked to refrain from toothbrushing on the treated area. All patients received regular plaque control until 1 year postoperatively.

Figure 1. Tunneling Technique: A) View at baseline of the recession; B) Using a tunneling instrument, a full-thickness dissection was made through crevicular incision beyond the mucogingival line; C) The papillae area was elevated to provide flap mobility; D) Subepithelial connective tissue graft harvested from the palate was placed under the flap through the crevicular incision with the help of sutures; E) Suspended sutures were made to stabilize the flap in a coronal position; F) 6-months follow-up; Zucchelli and De Sanctis Technique: G) View at baseline of the recession; H) Oblique incisions were made from the cement-enamel junction of the central recession to the base of the recessions of neighboring teeth and the papillae were de-epithelialized; I) A partial-full thickness-partial flap was elevated beyond mucogingival line; J) A subepithelial connective tissue graft was removed prom the palate and placed under the flap; K) Interrupted sutures and suspended sutures were made to stabilize the graft in place and the flap in a coronal position; L) 6-month follow-up.

Clinical periodontal parameters

Before the surgical procedures, all clinical measures were recorded by a calibrated examiner, using a North Carolina periodontal probe n. 15 (Hu-Friedy®, USA). The measures were rounded to the nearest millimeter and repeated at baseline, 6 and 12 months after surgery.

Gingival recession depth (RD): distance in millimeters from the CEJ to the gingival margin on three points on the buccal surface (mesial, center and distal); Gingival recession width (RW): considered the distance between buccomesial and buccodistal gingival margins of the recession, taking as reference a virtual line tangent to the most apical point of the CEJ; Keratinized tissue width (KTW): distance in millimeters from the gingival margin to the mucogingival junction on the central region of each tooth; Keratinized tissue thickness (KTT): determined 1.5mm apically to the gingival margin on the central point of the buccal surface, using an anesthetic needle with an endodontic stop and a digital caliper; Bone dehiscence (BD): distance in millimeters from the CEJ to the bone crest, obtained during surgery; Sensitivity (SEN): value achieved by the application of a visual analogue scale, in which the patient scored a value between 0 (absence of sensitivity) and 10 (extreme sensitivity) to describe the sensation on each tooth analyzed; Vertical coverage (VC):

percentage difference in RD variation between the study period and the baseline value; Horizontal coverage (HC): percentage difference in RW variation between the study period and the baseline value.

Vertical and horizontal coverage was calculated using a rule of three, as follows:

- Initial vertical/horizontal recession – 100%
- (Initial vertical/horizonta recession – Final vertical/horizontal recession) – X%

Data analysis

The values were described as means and standard deviation. The comparison between RD, RW, KTW, KTT and SEN measures on baseline and at 6 and 12 months after surgery was performed by the ANOVA for repeated measures and Tukey test. The comparison between HC and VC between 6 and 12 months was performed by the paired t test. The comparison between variables analyzed and the region of recessions (mandible and maxilla), Miller classification of GR (I and II) and surgical technique employed was performed by the t test. The relationship between periodontal parameters was analyzed by the Pearson correlation coefficient. All tests adopted a significance level of 5% ($p<0.05$).

Results

The study included 17 individuals (9 females and 8 males) and 46 gingival recession sites analyzed by an experienced and calibrated examiner (ICC-0.98). Baseline values and outcomes after 6 and 12 months are presented in Table 1. There was significant reduction in RD, RW and SEN values between baseline and 6 and 12 months, but not between postoperative periods. Similarly, there was significant increase in KTW between baseline and 6 and 12 months, but not between the two latter. Conversely, the KTT presented a constant increase, being statistically significant between baseline, 6 months and 12 months. Concerning the percentage of coverage, no difference was found between 6 months and 12 months both for VC and HC (Table 2).

Correlation between periodontal variables and areas of recessions (Table 3) indicated that, on baseline, the KTT was greater in the maxilla compared to the mandible. Also, the VC was greater in the maxilla at 6 months, while sensitivity was greater in the mandible at 12 months. Sample stratification according to the Miller classification of GR revealed the expected outcome that class II recessions presented greater depth and width than class I GR on baseline. This significance persisted at 6 months, indicating that class II recessions still had greater RD and RW after treatment. Conversely, class I recessions presented statistically greater RH at 6 months compared to class II. Regarding the surgical technique employed, Zucchelli and De Sanctis (2000) technique was used in cases with statistically higher values of RD, RW and BD on baseline. The tunneling technique was indicated for cases with shallower and narrower GR. There was greater percentage of HC and VC for tunneling at 6 months, without difference between techniques at 12 months.

Negative correlations were observed between initial RD and RW and HC and VC after 6 and 12 months. Thus, the greater the RD and RW, the lower the HC and VC. No correlation was found between initial KTW and KTT and HC and VC after 6 and 12 months. The correlation was also negative for the relationship between BD and HC and VC whereby the greater the BD, the lower the VC and HC after 6 months. A negative correlation was also observed for sensitivity such that the greater the VC, the lower the sensitivity after 6 and 12 months.

Table 1. Values of periodontal parameters evaluated on baseline and after 6 months and 12 months (mean ± s.d.).

	Baseline	6 months	12 months
RD (mm)	2.73 ± 1.08	1.04 ± 1.21 [a*]	1.13 ± 1.08 [a*]
RW (mm)	4.02 ± 1.45	2.15 ± 2.44 [a*]	2.32 ± 2.28 [a*]
KTW (mm)	2.43 ± 1.32	3.5 ± 1.44 [a*]	3.67 ± 1.73 [a*]
KTT (mm)	0.86 ± 0.38	1.43 ± 0.59 [a*]	1.84 ± 0.77 [b*]
BD (mm)	5.80 ± 2.08	-	-
SEN (VAS)	2.43 ± 2.97	1.26 ± 2.12 [a*]	0.86 ± 1.86 [a*]

RD: recession depht; RW: recession width; KTW: keratinized tissue width; KTT: keratinized tissue thickness; BD: bone dehiscence; SEN: sensitivity.
*ANOVA for repeated measures and Tukey test: equal letters on the line indicate absence of significant differences between periods; different letters on the line indicate significant differences ($p< 0.05$) between periods.

Table 2. Percentage of root coverage observed at 6 and 12 months compared to the baseline (mean ± s.d.).

	6 months	12 months	p*
Vertical coverage (%)	68.55 ± 34.30	61.88 ± 34.94	0.16
Horizontal coverage (%)	56.26 ± 44.23	46.82 ± 43.30	0.10

*Paired t test

Table 3. Evaluation of periodontal parameters stratified into categories.

	Region			Miller classification			Surgical technique		
	Maxilla	Mandible	p*	I	II	p*	Zucchelli	Tunneling	p*
	n = 35	n = 11		n = 32	n = 14		n = 34	n = 12	
Baseline									
RD (mm)	2.77 ± 1.08	2.63 ± 1.12	0.72	2.43 ± 0.91	3.42 ± 1.15	0.003	3.02 ± 1.02	1.91 ± 0.79	0.001
RW (mm)	3.97± 1.27	4.18 ± 1.99	0.68	3.65 ± 1.12	4.85 ± 1.79	0.008	4.35 ± 1.45	3.08 ± 0.99	0.008
KTW (mm)	2.57 ± 1.14	2.00 ± 1.78	0.21	2.65 ± 1.26	1.92 ± 1.38	0.08	2.55 ± 1.25	2.08 ± 1.50	0.29
KTT (mm)	0.92 ± 0.39	0.66 ± 0.32	0.04	0.86 ± 0.32	0.84 ± 0.52	0.85	0.85 ± 0.39	0.87 ± 0.37	0.87
BD(mm)	5.80 ± 2.05	5.81 ± 2.27	0.98	5.43 ± 2.09	6.64 ±1.86	0.07	6.32 ± 2.12	4.33 ± 0.98	0.003
SEN	2.65 ± 3.12	1.72 ± 2.41	0.37	1.96 ± 2.20	3.5 ± 4.14	0.10	2.76 ± 3.27	1.50 ± 1.62	0.20
6 months									
RD (mm)	0.85 ± 0.97	1.63 ± 1.68	0.06	0.75 ± 0.98	1.71 ± 1.43	0.01	1.23 ± 1.28	0.50 ± 0.79	0.07
RW (mm)	1.88 ± 2.05	3.00 ± 3.37	0.19	1.59 ± 1.99	3.42 ± 2.92	0.01	2.64 ± 2.58	0.75 ± 1.21	0.01
KTW (mm)	3.57 ± 1.14	3.27 ± 2.19	0.55	3.53 ± 1.34	3.42 ± 1.69	0.82	3.61 ± 1.34	3.16 ± 1.69	0.35
KTT (mm)	1.49 ± 0.57	1.24 ± 0.64	0.21	1.47 ± 0.47	1.35 ± 0.81	0.51	1.46 ± 0.65	1.35 ± 0.39	0.58
VC (%)	74.14 ± 29.69	50.75 ± 42.89	0.04	74.73 ± 32.75	54.40 ± 34.70	0.06	64.31 ± 35.35	80.55 ± 29.15	0.16
HC (%)	59.90 ± 42.72	44.69 ± 49.02	0.32	64.73 ± 42.76	36.90 ± 42.80	0.04	47.69 ± 45.44	80.55 ± 30.63	0.02
SEN	1.11 ± 1.85	1.72 ± 2.86	0.41	1.09 ± 2.02	1.64 ± 2.37	0.42	1.58 ± 2.37	0.33 ± 0.49	0.07
12 months									
RD (mm)	1.00 ± 0.93	1.54 ± 1.43	0.14	0.93 ± 1.04	1.57 ± 1.08	0.06	1.23 ± 1.12	0.83 ± 0.93	0.27
RW (mm)	2.02 ± 1.93	3.27 ± 3.06	0.11	1.87 ± 2.02	3.35 ± 2.56	0.04	2.52 ± 2.42	1.75 ± 1.76	0.31
KTW (mm)	3.68 ± 1.51	3.63 ± 2.41	0.93	3.50 ± 1.48	4.07 ± 2.23	0.31	3.85 ± 1.84	3.16 ± 1.33	0.24
KTT (mm)	1.97 ± 0.80	1.42 ± 0.48	0.03	1.85 ± 0.79	1.81 ± 0.75	0.87	1.96 ± 0.78	1.48 ±0.62	0.06
VC (%)	65.76 ± 32.64	49.54 ± 40.64	0.18	65.88 ± 36.37	52.73 ± 30.69	0.24	62.15 ± 34.22	61.11 ± 38.49	0.93
HC (%)	50.71 ± 46.05	34.46 ± 47.07	0.31	52.86 ± 48.19	33.03 ± 39.84	0.18	46.69 ± 45.65	47.22 ± 50.16	0.97
SEN	0.45 ± 0.74	2.18 ± 3.37	0.006	0.59 ± 1.13	1.50 ± 2.90	0.13	1.00 ± 2.14	0.50 ± 0.52	0.43

RD: recession depth; RW: recession width; KTW: keratinized tissue width; KTT: keratinized tissue thickness;
BD: bone dehiscence; SEN: sensitivity; VC: vertical coverage; HC: horizontal coverage.
*Pearson correlation

Discussion

This longitudinal retrospective clinical study demonstrated that surgical treatment with SCTG in areas of multiple GR reduced the depth and width of GR, and there was also gains in width and thickness of keratinized tissue and reduction in sensitivity. Additionally, it was observed that the smaller the depth and width of GR, the greater the root coverage, but no correlation was observed between width and thickness of keratinized tissue and root coverage. The extent of bone dehiscence was also related with root coverage, as well as with the reduction in sensitivity.

Several factors are associated with the predictability of root coverage. These factors can be classified into patient-specific, site-specific and technical considerations (Richardson *et al.*, 2015) and should be considered for the prediction of clinical outcomes and potential need for re-intervention. Our sample was also evaluated according to Miller classification (Miller, 1985) instead of using the more recently recommended Cairo *et al.* (2011) classification so the impact of root coverage in the presence or absence of keratinized tissue apically to the recession could also be inspected. Besides, depth of GR, presence of frenula, root prominence, root caries, non-carious cervical lesions, vestibule depth and thin and thick phenotype (Richardson *et al.*, 2015) was analyzed. The depth of GR plays an important role in the prognosis of treatment for root coverage, but the width of GR should also be considered. This study revealed that both parameters influenced the treatment prognosis whereby the dimension of vertical and horizontal defect impacts on root coverage. These results corroborate those reported by Chambrone *et al.* (2010) and Rocuzzo *et al.* (2002), suggesting that recession less than 4 mm may present superior results in percentage of root coverage, as well as the influence of postoperative position of the gingival margin.

Larger recession defects are more challenging to manage than narrow defefcts (Sullivan and Atkins, 1968). It has ben reported that the mean width of recession is greater in the group with partial coverage, but this does not appear to be statistically significant different (Huang *et al.* 2005),. Conversely, the influence of the initial depth of GR on root coverage remains controversial, and the initial depth remains similar for both partial and total coverage. Other studies have demonstrated that deeper initial GR presents inferior percentage of root coverage results (Harris, 2002; Clauser *et al.*, 2003). In addition to the recession depth, the extent of bone dehiscence is also related with root coverage. Trombelli *et al.* (2017) also observed an important influence of bone dehiscence on the gingival margin stability after treatment of intraosseous defects using a single flap approach. In their results, areas with shallow dehiscences (3 to 5 mm) do not present statistical difference when treated with or without association of SCTG. However, deep dehiscences (> 5 mm), as found in this study (mean 5.8 mm), presented statistically significant increase in buccal GR at 6 months when a SCTG was not used with the surgical technique. Thus, they concluded that the depth of bone dehiscence influences the technique outcomes, requiring the use of SCTG only in cases with deeper defects. Possibly the presence of a larger avascular area in deep dehiscences is responsible for influencing the clinical outcomes.

There was a tendency without statistical significance of better outcomes for maxillary compared to mandibular teeth. Among treated teeth, mandibular premolars were the most challenging (mean CR, 32.2% -17.3%). According to Chambrone and Tatakis (2015) systematic review, the majority of treated sites are canines and pre-molars, with more predictable results in the maxilla than in the mandible.

Flap thickness is also considered an important variable to increase the potential success of root coverage procedures (Richardson *et al.*, 2015). Thus, maintenance of the gingival tissue thickness during flap preparation is important and it is preferred to raise the flap using a combination of total and partial thickness, to allow the thicker portion of the flap, which includes the periosteum, to remain on the avascular root surface (Sanz *et al.*, 2014). It is currently known that a flap thickness greater than 0.8 mm covering a SCTG results in a better prognosis for root surface coverage (Richardson *et al.*, 2015). In the present study, the mean KTT was 0.86 mm, which may explain the lower rate of root coverage compared to the literature. The lower mean KTT in the mandible (0.66mm) may also have contributed to the lower percentage of root coverage in these areas. In addition, only multiple GRs were included, which are more challenging defects compared to isolated GR (Cairo, 2017).

The importance of the gingival phenotype for the predictability of root coverage procedures has been widely discussed (Chambrone *et al.*, 2010). In the present study, both KTW and KTT had no influence on vertical and horizontal coverage. Kahn *et al.* (2016) evaluated the influence of gingival thickness on GR root coverage rates and reported that this parameter does not seem to have a significant influence on root coverage in class I and II GR. Harris (1997) also cited favorable results in root coverage procedures and did not observe relationship with thickness. Notwithstanding, the literature reports that the phenotype should be modified to prevent the relapse or worsening of GR (Chambrone and Tatakis, 2016). Kim and Neiva (2015) further reported that each patient should be individually evaluated concerning the indication of therapy. The definition of gingival phenotype is of extreme importance, since individuals with different phenotypes may react differently to traumatic factors. A thin phenotype has more probability to develop gingival recessions than a thicker phenotype. Furthermore, a thicker gingival phenotype is related to a tick bony plate, while a thinner gingival phenotype is associated with a thin bony plate, increasing the chance to develop fenestrations and dehiscence. (Kim and Neiva, 2015).

Frequently, GR is associated with esthetic impairment and dentin hypersensitivity (Chambrone *et al.*, 2010). However, some authors have not demonstrated any relationship between sensitivity and depth of GR (Nieri *et al.*, 2009). This lack of association can be clinically observed in shallow recessions that are highly sensitive and, in some cases, deep recessions do not demonstrate any sensitivity symptoms (Kahn *et al.*, 2016). However, in the present study, after treatment, it was observed that the greater the root coverage rate, the lower the sensitivity, evidencing that the area of root exposure associated with GR is an important factor influencing hypersensitivity.

The anatomical characteristics of the GR also influence the treatment. For this reason, Miller (1985) proposed a classification for GR according to the characteristics of the surrounding periodontal tissue, relating these points to the treatment predictability. The present study included only Miller class I and II recessions. In both cases, there is no loss of proximal bone or soft tissue, and the difference is only related to the presence or absence of gingiva inserted apically to the GR (Miller, 2018). For these defects, Miller (1985) observed complete root coverage in 100% of treated class I recessions and 87.9% of class II GR. Other recent studies corroborate these results (Chaparro *et al.*, 2015; Vincent-Bugnas *et al.*, 2018). In the present study, treated class II recessions were wider and longer than GR class I, but only the width remained statistically significant after 12 months. This difference may be explained by the fact that, in both types of defects, there was no difference in the percentage of root coverage during the study, maintaining a similar number of residual recessions in the groups. However, Pini-Prato (2011) pointed out that the inclusion of GR in a classification cannot be considered the only prognostic factor in the predictability of root coverage. Therefore, several factors related to the site and patient should be considered when planning the treatment of GR: gingival biotype (gingival thickness and keratinized tissue width), bone morphotype and tooth dimension (Cortellini and Bissada, 2018).

There are several variations of techniques associated with SCTG for the treatment of multiple GR. The technique of Zucchelli and De Sanctis (2000) consists of a flap without releasing incisions and presents good clinical results in the short- and long-term stability of root coverage and esthetics. The tunneling technique is considered minimally invasive because it does not involve papillae in proximal incisions (Allen, 1994). Technically, it may be observed that, by maintaining the papilla apex insertion, the tunneling technique also reduces the flap release in coronal direction, being more indicated by our group for shallower GR. In the present study, a higher potential of root coverage was observed for the tunneling technique compared to the technique of Zucchelli and De Sanctis (2000). However, due to the lower proportion of cases with indication for tunneling, this difference should be carefully analyzed, since results indicated equivalence in root coverage between the techniques have already been reported in the literature (Gobbato *et al.*, 2016), only with increase in chair time and initial postoperative discomfort when the tunneling technique is used.

Despite some limitations of the present study concerning the sample size and technical variations (recepient and donor sites), it was demonstrated that different site-specific factors may influence the success of root coverage after SCTG associated with CAF. Therefore, further studies on larger samples should be conducted to obtain complementary results to this research.

Conclusion

Root coverage is influenced by different site-specific factors in the middle and long term, including the dental arch, width and depth of GR, and bone dehiscence. The surgical technique may also have an influence, with correlation between root coverage and the reduction in sensitivity reported by the patient.

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