Original Research Article

Clinical comparison of two surgical techniques in the treatment of Cairo RT2 gingival recessions associated to subepithelial connective tissue graft: randomized clinical trial

Abstract

Purpose: The treatment of advanced gingival recessions represents a clinical challenge due to lack of appropriate interdental support. The objective of this study was to compare the outcomes of root coverage in surgical techniques employed for Tunnel root coverage and Coronally Positioned Flap (CPF), both associated to Subepithelial Connective Tissue Graft (SCTG), in patients with Cairo RT2 gingival recession.

Methods: Forty-one Cairo RT2 recessions were selected in 18 patients divided in groups to undergo root coverage surgery. The patients were evaluated at 0, 90, and 180 post-operative days for verification of the recession height and width, probing depth, bleeding on probing, clinical attachment level, gingival thickness, and zone of keratinized tissue ($P<0.05\%$).

Results: There was 1.84 ± 1.03 mm gain in gingival height in the Tunnel + SCTG group, and 2.33 ± 0.90mm in CPF + SCTG group, without statistically significant differences across groups, and the coverage average was 62%. Full coverage was obtained in 17% of recessions.

Conclusion: The two techniques presented significant improvement in the periodontal parameters evaluated. Only the keratinized gingiva presented better outcomes in the CPF group.

Keywords: Gingival recession, connective tissue graft, root coverage, periodontal surgery.

Introduction

Gingival recessions belong to a group of mucogingival deformities that affect adult patients, and tend to increase with age, bringing conditions like dentin hypersensitivity, carious cervical lesions, and aesthetic impairment [1]. Gingival recession is defined as the apical displacement of the marginal gingiva against the cementoenamel junction (CEJ) [2], which causes root surface exposure in one or multiple faces [1,3,4].

Some etiological factors have been associated to recessions, including plaque-induced inflammation, traumatic brushing, malposition of teeth, traumatic occlusion, previous orthodontic treatment, sub gingival restoration, attachment of brakes and bridles next to the gingival margin, bone dehiscences, and thin gum tissue [3,5,6]. To obtain success in the treatment, it is necessary to identify and control predisposing and triggering factors [7].

The recession size and degree are among the facts that interfere with the treatment outcome [5]. Miller [8] classification (Class I, II, III, and IV) is still the most frequent in the literature, however, Cairo classification is currently used: RT1: soft tissue recessions that do not present interproximal attachment loss; RT2: where there is loss of interproximal attachment, with distance from CEJ to the bottom of the sulcus shorter or equal to the loss of vestibular attachment; and RT3: Loss of interproximal attachment, with distance from CEJ to the bottom of the sulcus greater than the loss of vestibular attachment [9].

Recession treatment is made through a regenerative surgical procedure called root coverage, in order to restore the loss of periodontal attachment [7,10]. However, advanced gingival defects have less favorable prognosis and lower predictability. This occurs due to the limited interdental support of RT2 recessions, which compromises the recipient bed and blood supply [3,11,12].

There are several surgical techniques for the treatment of gingival recessions, with different types of incisions, with or without relaxing, using grafts or not [4,13,14]. Despite the

different methods of treatment developed and improved for treatment of Cairo RT2 and RT3 recessions, there is no consensus about the most recommended technique [12,15,16].

Tunneling is a technique that eliminates the need of horizontal or vertical incisions, providing better aesthetic outcomes [6]. It presents some advantages, with fewer scars, more gingival blood supply and better post-operative phase due to less tissue manipulation [3,17].

Considered golden standard for the treatment of gingival recessions, the Coronally Positioned Flap (CPF) is the most used [6,11,17]. The CPF technique main advantage is its high level of success and long term stability [17]. However, such technique presents some disadvantages, like cicatricial lines and greater tissue manipulation [18,19].

The Subepithelial Connective Tissue Graft (SCTG) results from the removal of a portion of tissue in a donor area, most commonly the patient's own palate. In association with some coverage surgical technique, the SCTG is already broadly used due to the graft predictability [14,19].

The present study's objective is to compare the outcomes of root coverage in CPF and Tunnel techniques, both associated to SCTG, in root coverage surgeries in patients with RT2 gingival recession, for 180 days.

Materials and Methods

Study design:

This is an applied clinical research, prospective, parallel, and randomized study. The proposal was submitted and approved by Unioeste Human Research Ethics Committee (opinion number: 4.148.988, CAAE: 33911920.3.0000.0107, July 10, 2020). The study was conducted at Unioeste Cascavel Campus' Dentistry Course's Clinics. After approval by the Ethics Committee, this study's objective was explained to all patients. Participants are those that agreed with participating and signed the Informed Consent Form.

Eighteen patients with 41 recessions were selected according to inclusion criteria and based on the analysis of sample size calculation made through Graph Pad Prism 8.0® software. The number of patients was based on previous analyses, through 80% test power and 0.05 alpha level, and these data were also based on previous studies by the group of researchers [20–22].

As inclusion criteria, patients from 20 to 60 years old were chosen, from both genders, which presented Cairo RT2 gingival recession with up to 5mm high and 3mm wide. The teeth were premolar, canine or incisor on at least one the arches, should be healthy, with all sites presenting probing depth shorter or equal to 3mm, with bleeding rate lower or equal to 5%, without gingival inflammation and caries.

However, patients with positive history of antibiotic therapy in the last six months and anti-inflammatory therapy, steroid or not, in the three months prior to the study; positive history of pregnancy; history of tobacco use or definitive interruption of the habit in up to five (5) years; history of any systemic problem that contra-indicated the surgical procedure; endodontic treatment or pulp pathology in the tooth involved; pathogenic occlusal interferences and previous surgeries in the location were excluded. The medical record of each patient was obtained by anamnesis, and all participants underwent physical examination.

The initial physical/periodontal examination was conducted by a single previously trained researcher who, by Willians Type 23 periodontal probe, determined:

1. Recession height: distance from the cementoenamel junction to the gingival margin, measured in mm;
2. Recession width: mesiodistal distance from the gingival margin, measured in mm;
3. Probing depth: distance from the gingival margin (GM) to the sulcus bottom, measured in mm;

4. Bleeding on Probing: with approximately 30 seconds interval for parameter record, which corresponds to the probing time with record of presence or absence;
5. Clinical attachment level: distance from the cementoenamel junction (CEJ) to the sulcus bottom, measured in mm. Obtained from the sum of gingival recession height and probing depth;
6. Height of keratinized tissue zone: distance from the mucogingival junction to the gingival margin, measured in mm;
7. Thickness of the keratinized gingival tissue: distance from the epithelial tissue to the buccal bone plate at the height of the attached gingiva. Obtained with anesthetic needle and measured in mm.

After the periodontal examination, each recession was randomly allocated, through draw, in one of the groups, according to the treatments proposed in table 1, and surgeries were performed by a single surgeon.

Considering that Cairo RT2 injuries are caused by factors that include appropriate oral hygiene, patient incapacity or difficulty to efficiently remove the plaque, along with some predisposing factors [3,5,6], all subjects were engaged in a Basing Periodontal Treatment Program and follow-up to eliminate eventual etiological factor and prevent recurrence. This program included manual instrumentation with Gracey periodontal curettes 5/6, 7/8,11/12 and 13/14 (*Hu-Friedy, Chicago, IL, USA*), in addition to possible occlusal adjustments, raising awareness with regard to food habits and oral hygiene guidance (brushing with modified Bass technique, with soft brush and floss). All patients received periodontal maintenance therapy.

Surgical techniques:

Tunneling technique [23]:

The recipient area was anesthetized with infiltrative terminal anesthesia, with anesthetic Mepivacaine 2% and Epinephrine 1:100.000 (*DFL, Rio de Janeiro, RJ, Brasil*). Intrasulcus

incision was made without involving papillae, with 15c blade (SOLIDOR® *SuzhouKyuan Medical Apparatus Co. Ltd., Suzhou City, Beiqiao Town, China*) and, then, the tunnel was created for mesial and distal with tunnelers (*Supremo Instrumentais Cirúrgicos, São Paulo, Brasil*). A flap with partial thickness was created next to the gingival margin until surpassing the mucogingival junction, followed by flap division as 'fan', going beyond the recession limits, in order to obtain a tissue without tensions. The tooth root was scraped and smoothened with Gracey type periodontal curette (*Hu-Friedy, Chicago, IL, USA*), followed by abundant irrigation with saline solution 0.9% (Figures 1A and 1B). The graft was embedded in the tunnelized region, being positioned on the gingival recession, and then stabilized at the proximal with polypropylene yarn 5.0 (*TECHSUTURE®, Bauru, São Paulo, Brasil*) at the CEJ level. The tissue was later coronally tractioned and stabilized with sutures, also using the polypropylene yarn 5.0 (*TECHSUTURE*®) (Figures 1C-F).

[Insert Figure 1]

The coronally positioned flap technique [24]:

The recipient area was anesthetized with infiltrative terminal anesthesia, with anesthetic Mepivacaine 2% and Epinephrine 1:100.000 (*DFL).* Intrasulcus incision was made with 15c blade (SOLIDOR®), horizontal incisions on the papillae base, at CEJ level, for mesial and distal, and relaxing vertical incisions, and the papillae epithelium was removed. Full mucoperiosteal detachment was made until the mucogingival line, and from this, a partial thickness flap was created to obtain a flap without tensions (Figures 2A-C). The tooth root was scraped and smoothened with Gracey type periodontal curette (*Hu-Friedy*), followed by abundant irrigation with saline solution 0.9% (Figures 1A and 1B). The graft was positioned on the recession and stabilized with polypropylene yarn 5.0 (*TECHSUTURE*®). The flap was

later coronally tractioned and stabilized on the graft, also using polypropylene yarn 5.0 (*TECHSUTURE*®) (Figures 2D -F).

[Insert Figure 2]

Obtention of subepithelial connective tissue graft:

The SCTG was obtained from the palate using the linear incision technique to remove the graft with 1.5 to 2mm in thickness and length enough to cover the exposed root area [25]. After graft removal, the palate was slightly pressed with gauze to promote vasoconstriction, and then suture was made to stabilize the clot with Nylon 5.0 suture yarn (*SHALON® São Luis M. Belos, Goiás, Brasil*). The graft was inserted in subepithelial position, on the exposed root surface and covered by the recipient epithelium, which was previously prepared through one of the surgical techniques [26].

Control and post-operative evaluations:

The patients received pain control medications, antibiotic therapy, non steroidal anti inflammatory, analgesic and mouthwash (Amoxicillin 500mg every 8 hours for 7 days, Nimesulide 100mg every 12 hours for 3 days, Sodium Dipyrone 500mg every 6 hours for 3 days, and Chlorhexidine Digluconate 0.12% every 12 hours, mouthwash for 7 days, and hygiene with swab on the suture region for 15 days). The donor area sutures were removed after 7 days, and the recipient bed sutures were removed after 15 days. The patients also received post-operative instructions to avoid any mechanical trauma from brushing on the operated area.

The patients were evaluated for 180 days, with clinical examinations at 0, 90, and 180 days. In all periods the patients received maintenance therapy, and all criteria from the initial periodontal examination were re-assessed. After 180 days from the experimental period, all patients were included in a periodontal maintenance program.

Statistical Analysis:

As to the statistical analysis, the software used was Graph Pad Prism 8.0®. The clinical data obtained were analyzed and assessed, initially, with SHAPIRO-WILK test to verify normality distribution. ANOVA tests were later used for repeated measures and TUKEY for analysis between periods in the same group. STUDENT'S T test was used for analysis of the differences across groups. For the bleeding parameter, FRIEDMAN test was used. All tests were conducted with 5% significance level.

Results

Forty-one gingival recessions were analyzed, 23 from the Tunnel + SCTG group, and 18 from the CPF + SCTG group. Of the total, 80% (33 recessions) were located in teeth from the lower arch, while 20% (8 recessions) were in teeth from the upper arch. All patients participating in the study were female, with average age from 37 ± 9.02 years old; 36 ± 8.27 years old in the Tunnel group, and 41 ± 9.68 years old in the CPF group.

[Insert Table 1]

Table 2 shows periodontal clinical parameters' values of Tunnel + SCTG group analyzed before the treatment and followed up to 180 days. All parameters presented statistically significant improvements after the 180-day follow-up ($p<0.05$), except for probing depth and bleeding rate, which were statistically similar, demonstrating periodontal health that remained during the whole follow-up period.

[Insert Table 2]

Table 3 demonstrates CPF + SCTG group periodontal clinical parameters' values, analyzed before the treatment and after 180 days. All parameters presented statistically significant improvements, except for probing depth and bleeding rate, demonstrating periodontal health that remained during the follow-up period, as occurred in the Tunnel group.

[Insert Table 3]

Table 4 shows the comparison of averages variations (initial and after 180 days) of each periodontal parameter between Tunnel + SCTG and CPF + SCTG groups. No statistically significant differences were observed between the two groups for most parameters analyzed. Statistical difference was only observed in the height of the attached gingiva, and CPF + SCTG technique obtained better outcomes in this aspect.

[Insert Table 4]

An average of 62% of coverage was observed across all RT2 gingival recessions treated, 56% for the Tunnel technique, and 68% for the CPF technique. After 180 days, of the 41 recessions, full coverage was obtained for 7 teeth (17%); 3 in the Tunnel + SCTG group and 4 in the CPF + SCTG group.

Some patients reported more intense post-operative pain in the donor area than in the graft area. Some patients from the CPF group reported discomfort in the graft area after 5 days of the post-operative period. Edema and discomfort were reported by patients in this study on the first post-operative days. No discomfort was mentioned in the first week.

However, all patients stated that they would undergo the procedure again, if necessary, particularly due to the esthetic improvement obtained.

Discussion

Mucogingival plastic surgery procedures represent challenges for the success of gingival recession coverage, in addition to the many systemic, local anatomic and behavior conditions of the patients that may influence the treatment and prognosis of recessions [6,22]. Gingival recessions affect a high percentage of the population. In a study conducted with the Brazilian population, it was observed that 83.4%, 51.6% and 22% of the individuals presented recessions ≥ 1mm, ≥ 3mm and ≥ 5mm, respectively, and that there is association between prevalence and extension to the age of the individuals and the degree of hygiene [27]. Moreover, in populations presenting good hygiene standards, recession is found mainly in buccal surfaces, many times caused by traumatic brushing. However, in populations that keep poor hygiene, all dental surfaces are usually affected, causing loss of interdental structure, as occurs in RT2 recessions [7,13,28].

The surgical management of Miller Class III and IV defects is acknowledged as more difficult when compared to those from Miller Class I-II, which is due to higher or full loss of papilla and interdental bone, resulting in impairment of the recipient bed and blood supply to the grafted tissue [11]. Moreover, larger recessions also have less favorable prognosis. Full root coverage can be expected in Miller classes I and II gingival recessions, however, classes III and IV have poor predictability [7,12,16].

There is lack of evidence for the management of more serious gingival recessions in the adult population, which renders difficult the critical assessment of these interventions' efficacy [11]. However, some findings demonstrated increase of coverage percent in more extensive recessions to a very significant rate (reaching 80%), with possibility of obtaining

full coverage of these defects [3,16]. For that, the gingival marginal level of the teeth adjacent to the recession can be considered a clinical parameter to plan and predict the outcomes in recession treatment, because the maximum level of coverage is determined by the proximal bone crest height [18].

The use of SCTG promotes increase in flap thickness, favoring the clinical results like insertion gain in keratinized tissue and root coverage, representing a satisfactory and predictable alternative for the treatment of gingival recessions [10]. Due to these advantages, already well established in the literature, it was used in this study associated to Tunnel and CPF surgical techniques. When these two techniques were compared in Miller class I and II recessions, researchers obtained effective outcomes in both techniques [22]. While comparing its use in RT2 recessions, good effectiveness and similar outcomes across the parameters analyzed after use of these techniques were observed (Tables 2 and 3).

The Tunnel technique has been suggested as a valuable approach for the treatment of Miller Class I, II and III deep gingival recessions [4]. In a randomized clinical research produced for the treatment of Miller class III gingival recessions, the Tunnel technique associated to SCTG resulted in full coverage of 8 surgeries from the 20 surgeries performed (38%) [12]. In other study, full coverage percent in Miller class III recessions was 14.3% [6], corroborating the present study, where the percent reached was 17% for Cairo RT2.

Where the CPF technique associated to SCTG was used in a pilot study for coverage in Miller class III gingival recessions, it resulted in 69% of coverage and none of the areas presented 100%, showing that the technique was successful for partial coverage [29]. The present study corroborated the results found in the literature (Table 3), where it could be observed 68% of coverage using the CPF technique in Cairo RT2 recessions.

The CPF technique has its advantages well established in the literature, and for this reason it is considered the golden standard technique. The advantage of using the Tunnel

technique is that it doesn't involve relaxing incisions, which results in improvement of the graft nutrition and post-operative morbidity, eliminating the possibility of scar formation, and optimizing the final esthetic aspect [17]. However, the Tunnel technique in mandibular areas presents limitation of coronal mobilization due to the local anatomy [6]. In order to obtain a flap without tension, muscle incisions and incision in collagen fibers can be made in the inner portion of the graft, however, it makes the technique even more meticulous, particularly in patients with thin gingival type. The thickness, management and adaptation of the graft without tensions are critical factors to obtain predictable root coverage, and must be performed thoroughly to achieve success, both in CPF technique and Tunnel technique [10].

According to the literature, after 5 months of root coverage with the surgical techniques used in this study, some level of regeneration in periodontal defects can be observed, and formation of new cement, alveolar bone, and periodontal ligament can be obtained, as well as large portions of the root covered by connective tissue and long junctional epithelium [22,30–32]. Though CPF + SCTG present better outcomes in periodontal parameters, they are not statistically significant, demonstrating that both techniques can be recommended for the treatment of RT2 recessions in patients. The exception was demonstrated only for the more significant height of the attached gingiva after 180 days in the CPF + SCTG group, suggesting that it is still the most recommended for the treatment of RT2 recessions. This difference may indicate that in these cases the anatomy of the deeper recession can be a critical factor for gain of the attached gingiva with tunneling procedures, due to the challenge of moving the flap coronally to the mucogingival junction [3].

Though it is not always possible to obtain full coverage, with regard to the patient-centered results, the procedures are safe and can reach root coverage and esthetic improvement [18]. Some modalities are being added to the treatments, presenting positive results, with more stability in the root coverage using matrix derived from enamel [11], higher

coverage rate and lower post-operative morbidity rate, with the use of micro-surgical instruments [33] and better post-operative period without need of donor surgical area with use of A-PRF instead of SCTG [34]. These tools have proved to be promising for the improvement of techniques and can contribute to better outcomes in RT2 type recessions' coverage.

Based on the results analyzed, it was observed that the two techniques presented significant improvement in the periodontal parameters assessed, which were stable after 180 days. However, the CPF technique presented higher height of attached gingiva against the Tunnel technique.

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Tables

Table 1 – Sample distribution, according to the proposed treatments.

Group	Surgical technique
Group 1: Tunnel + SCTG	Root coverage with SCTG associated with the Tunneling Technique.
Group 2: CPF + SCTG	Root coverage with SCTG associated with the Coronally Positioned Flap

SCTG= Subepithelial Connective Tissue Graft; Tunnel= Tunneling Technique; CPF= Coronally Positioned Flap.

Table 2 - Comparative analysis of the periodontal parameters of the Tunnel + SCTG group in the initial, 90 days and final period. Values represent mean ± standard deviation.

Parameters (mm)	**Tunnel + SCTG (Initial)**	**Tunnel + SCTG (90 days)**	**Tunnel + SCTG (180 days)**
Recession height	3.30 ± 0.97 A	1.68 ± 0.94 B	1.40 ± 1.00 B
Recession width	3.73 ± 0.81 A	2.38 ± 0.74 B	1.95 ± 1.04 B
Probing depth	1.83 ± 1.40 A	1.60 ± 1.51 A	1.33 ± 0.50 A
Bleeding on Probing (%)	0.13 ± 0.34 A	0.13 ± 0.34 A	0.17 ± 0.38 A
Clinical attachment level	4.52 ± 1.30 A	2.95 ± 1.32 B	2.81 ± 1.40 B
Height of keratinized tissue zone	1.26 ± 0.81 A	3.36 ± 1.21 B	4.00 ± 1.41 B
Thickness of the keratinized gingival tissue	1.00 ± 0.00 A	1.33 ± 0.48 B	1.36 ± 0.50 B

Different letters mean they are statistically different within each treatment group ($P<0.05$).

Table 3 - Comparative analysis of the periodontal parameters of the CPF + SCTG group in the initial, 90 days and final period. Values represent mean ± standard deviation.

Parameters (mm)	CPF + SCTG (Initial)	CPF + SCTG (90 days)	CPF + SCTG (180 days)
Recession height	3.50 ± 1.38 A	1.50 ± 1.36 B	1.16 ± 1.04 B
Recession width	3.61 ± 0.69 A	1.88 ± 1.05 B	1.55 ± 0.98 B
Probing depth	1.18 ± 0.60 A	1.21 ± 0.42 A	1.41 ± 0.51 A
Bleeding on Probing (%)	0.11 ± 0.32 A	0.05 ± 0.23 A	0.22 ± 0.42 A
Clinical attachment level	4.61 ± 1.50 A	2.75 ± 1.65 B	2.50 ± 0.92 B
Height of keratinized tissue zone	1.61 ± 1.03 A	5.00 ± 1.71 B	5.94 ± 1.69 B
Thickness of the keratinized gingival tissue	1.00 ± 0.00 A	1.23 ± 0.43 B	1.50 ± 0.53 B

Different letters mean they are statistically different within each treatment group ($P<0.05$).

Table 4 - Comparative analysis of the variation (difference from 0 – 180 days) of the values of the periodontal parameters of the Tunnel + SCTG and CPF + SCTG groups. Values represent mean ± standard deviation.

Parameters (mm)	Tunnel + SCTG	CPF + SCTG
Recession height	1.84 ± 1.03 A	2.33 ± 0.90 A
Recession width	1.76 ± 1.18 A	2.05 ± 1.34 A
Probing depth	0.16 ± 0.48 A	-0.08 ± 0.47 A
Clinical attachment level	1.67 ± 0.94 A	2.11 ± 1.02 A
Height of keratinized tissue zone	-2.73 ± 1.32 A	-4.33 ± 1.41 B
Thickness of the keratinized gingival tissue	-0.65 ± 0.35 A	-0.80 ± 0.38 A

Different letters mean there is a statistically significant difference when comparing treatment groups ($p<0.05$).

FIGURES

Figure 1

Figure 2

Figure legends:

Figure 1: A -RT2 Cairo recession, initial appearance; B - Incision by the Tunnel technique and detachment of the receiver from the bed using tunnelers; C - Connective Tissue Graft ready to be inserted into the recipient bed; D- Stabilization of connective tissue; E - Immediate postoperative period with suture using 5.0 polypropylene thread; F - Postoperative appearance 180 days.

Figure 2: A -RT2 Cairo gingival recessions, initial appearance; B - Incision for the Coronary Positioned Flap technique. C - Detachment of the flap from the recipient bed; D - Connective Tissue Graft in position; E - Immediate postoperative period with suture using 5.0 polypropylene thread; F- Postoperative appearance at 180 days.