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Zucchelli's Technique or Tunnel Technique with Subepithelial Connective Tissue Graft for Treatment of Multiple Gingival Recessions

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Abstract

Background: Gingival recession is both unpleasant and unesthetic. Meeting the esthetic and functional demands of patients with multiple gingival recessions remains a major therapeutic challenge. We compared the clinical effectiveness of Zucchelli's technique and tunnel technique with subepithelial connective tissue graft (SECTG) for multiple gingival recessions.

Methods: Twenty systemically and periodontally healthy subjects having 75 recession defects (Miller's class I or II, 39 test and 36 control sites) were included. After initial nonsurgical therapy, test sites were treated with Zucchelli's technique and control sites with tunnel technique with SECTG. Plaque index, bleeding index, pocket depth, recession depth, clinical attachment level, and keratinized gingiva height were evaluated at baseline, 3 and 6 months post-surgery.

Results: The mean root coverage was 89.33% ± 14.47% and 80.00% ± 15.39% in the test and control groups respectively, with no significant difference between groups. Statistically significant root coverage was obtained for 82.50% ± 23.72% and 71.40% ± 20.93% of defects in the test and control groups, respectively.

Conclusion: Zucchelli's technique is effective for the treatment of multiple adjacent recessions in terms of both root coverage and keratinized tissue gain, irrespective of the number of defects. Moreover, this technique does not require an additional surgical site as required in the gold standard SECTG.

Key words: Multiple gingival recessions, Zucchelli's technique, connective tissue graft, envelope technique

Introduction

Gingival recession is defined as the apical displacement of the gingival margin in relation to the cementoenamel junction (CEJ, Glossary of Periodontology Terms, AAP, 2001). It is a common occurrence in individuals with poor oral hygiene as well as those with good oral hygiene, and it usually affects multiple teeth simultaneously. Occurrence in the anterior regions of the mouth leads to compromised esthetics. Therefore, many patients request cosmetic correction (Marmar *et al.*, 2009) and meeting their esthetic and functional demands remains a major therapeutic challenge (Philipe *et al.*, 2009). Several surgical approaches for covering exposed root surfaces, including free gingival graft placement (Miller, 1985), the coronally advanced flap (CAF; Harris *et al.*, 1995), subepithelial connective tissue graft (SECTG) placement (Langer and Langer, 1985; Paoloantonio *et al.*, 1997), the Langer and Langer technique (Langer and Langer, 1985) and guided tissue regeneration (Pini *et al.*, 1996) have been proposed in the last few decades.

The CAF is the first choice of surgical technique in cases with adequate keratinized tissue apical to the defect. It results in optimum root coverage, good color blending with respect to adjacent soft tissues, and good recovery of original soft tissue morphology. In most cases, SECTG is used in combination with CAFs. However, it necessitates vertical incisions on the buccal gingiva, which hampers

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blood supply and early esthetic recovery. To avoid these incisions on the recipient site, the envelope technique was advocated. The advantage of this procedure is the fast early healing that results from the absence of these external incisions (Zabalegui *et al.*, 1999).

Subepithelial connective tissue graft placement reportedly shows increased predictability of total root coverage and is regarded as the standard approach for the management of multiple gingival recessions (Langer and Langer, 1985). Chambrone *et al.* (2008) reported a systematic review that included 23 clinical trials on Miller's class I and II recession defects treated with SECTG with at least 10 participants per group. The authors concluded that SECTG provided significant root coverage, clinical attachment and keratinized tissue gain, and stated that SECTG is considered the "gold standard" procedure in the treatment of recession-type defects. The same authors, in their consecutive Cochrane systematic reviews in 2009 and 2010, stated that cases where both root coverage and keratinized tissue gain are expected, the use of SECTG seems to be ideal. Dembowska *et al.* (2007) stated that connective tissue grafts (CTGs) in combination with tunnel surgical techniques in the treatment of multiple adjacent gingival recessions resulted in significant root coverage of both class I and class II recessions, and increased keratinized gingival width.

It is important to note that the use of grafts in procedures involving root coverage gingival augmentation and aesthetics are always associated with complications. Harris *et al.* (2005) evaluated the incidence and severity of complications that occur after connective tissue grafts for root coverage or gingival augmentation (n = 500). The authors evaluated certain factors that could influence the rate of complications, including age, sex of patient, smoking status, purpose of the graft (i.e., for root coverage or for gingival augmentation), size of the recipient area, and location of the defect being treated. Complications evaluated included pain, bleeding, infection and swelling. The authors concluded that none of the factors evaluated in this study were associated with a statistically significant increase in the rate or intensity of complications, and the incidence and severity of complications seemed to be clinically acceptable.

In 2000, Zucchelli and De Sanctis demonstrated promising results with a new surgical approach (Zucchelli's technique; modification of the CAF) to treat multiple recession defects affecting adjacent teeth. To our knowledge, no study has compared the clinical effectiveness of Zucchelli's technique with that of techniques that use SECTGs for the treatment of multiple recession defects. This study compared the clinical effectiveness of Zucchelli's technique with that of the tunnel technique with SECTG placement for the treatment of multiple gingival recessions affecting adjacent teeth in the esthetic areas of the mouth.

Materials and methods

This study included 20 age- and sex-matched subjects (18 to 55 years) who were systemically and periodontally healthy and had a minimum of two recession (Miller's class I or II) defects affecting adjacent teeth in the esthetic areas of the maxilla. Subjects were recruited from the outpatient section of the Department of Periodontology & Oral Implantology, Dr. D. Y. Patil Dental College & Hospital, Pimpri, Pune. The study design was approved by the Institute's Scientific and Ethical Committee. Written informed consent was obtained from subjects who voluntarily agreed to participate after a detailed explanation of the study was provided to them. Affected teeth included those between 15 (maxillary 2nd right premolar) and 25 (2nd left premolar). All subjects demonstrated acceptable oral hygiene. Ten participants were allocated to each group (n = 20), which comprised a total of 75 recession defects. The power of the study was calculated based on comparing means of our two study groups, and was 80% at a confidence interval of 95% with a sample size of 10 per group. Participants were randomized into each group based on a computer-generated list. The test site included 39 defects, which were treated by Zucchelli's technique, and 36 control sites, which were treated by the tunnel technique with SECTG placement. The control sites were selected in subjects with medium to deep palatal vaults so that adequate graft material could be obtained. Exclusion criteria included the following: a history of prolonged use of antibiotics, steroids, immunosuppressive agents, aspirin, anticoagulants, or other medications that influence the periodontium; systemic diseases, such as diabetes, hypertension, HIV, cancer, and metabolic bone diseases; radiation therapy and immunosuppressive therapy; tobacco consumption; unacceptable oral hygiene; faulty tooth brushing technique; labially positioned teeth; teeth with prominent roots; and pregnancy.

Before surgery, a planned case history was recorded, followed by a complete periodontal evaluation. A complete haemogram was also obtained. Scores of the plaque index (Silness and Loe, 1964) and bleeding index (Loe and Silness, 1963) were calculated. Recession depth (RD) was measured from the CEJ to the most apical extension of the gingival margin. Probing depth (PD) was measured from the gingival margin to the base of the gingival sulcus. Keratinized gingiva height (KGH) was measured from the gingival margin to the mucogingival junction. Recession depth, PD, and KGH were measured using a William's graduated periodontal probe. All the above-mentioned parameters were recorded on the standardized chart at baseline and 3 and 6 months after surgery. Following initial examination, all subjects received oral prophylaxis and oral hygiene instructions. A coronally directed roll brushing technique was advised for teeth with recession defects in order to minimize brushing trauma to the gingival margin. Surgical treatment was scheduled once the patient demonstrated adequate supragingival plaque control (Zucchelli and De Sanctis, 2000).

To ensure adequate intra-clinician reproducibility, a previously trained clinician (CB) performed all surgeries in both groups, and all pre- and post-treatment clinical parameters and analyses were recorded by another examiner (AK), who was blinded to the type of surgery done. The examiner was considered calibrated once statistically significant correlation for RD, PD, and KGH were found and statistically non-significant differences between their duplicate measurements were obtained.

Surgical procedure

For the test group, local anesthesia was induced, following which the exposed root surfaces were planed with a combination of hand instruments and burs to eliminate any surface irregularities. The exposed surfaces were conditioned with tetracycline HCI solution (100 mg/ml) for 4 minutes with a light pressure burnishing technique as described previously (Tolga *et al.*, 2005) following which the root surfaces were thoroughly rinsed. A modified envelope flap (Zucchelli's technique) was used for the test subjects in this study. Horizontal incisions comprised oblique submarginal incisions placed in the interdental areas with the blade parallel to the tooth's long axis in order to dissect the surgical papillae in a split thickness manner. These incisions continued with the intrasulcular incision around the defects. Each surgical papilla was displaced with respect to the anatomic papilla by the oblique submarginal interdental incisions. In particular, the surgical papillae mesial to the flap midline were displaced apically and distally, while the papillae distal to the midline were displaced more apically and mesially. The envelope flap was raised with a split-full-split approach in the corono-apical direction; the surgical papillae were raised in a split thickness manner, the gingival tissue apical to the root exposure was raised in a full thickness manner to ensure adequate thickness for root coverage, and the most apical portion of the flap was elevated in a split thickness manner to facilitate coronal flap displacement. Of the exposed root surfaces, those that exhibited loss of clinical attachment level (CAL; recession + gingival sulcus) were subjected to mechanical curettage, whereas those in areas of bone dehiscence were not instrumented to avoid damage to any connective tissue fibers still inserted in the cementum. The remaining anatomic interdental papillae were de-epithelialized to create the connective tissue beds to which the surgical papillae would be sutured. A sharp dissection into the vestibular lining mucosa was performed to eliminate muscle tension. Adequate coronal displacement of the flap is facilitated by the elimination of lip and muscle tension in the apical portion. During coronal advancement, each surgical papilla was rotated towards the end of the flap to finally reside at the center of the interproximal area. Flap mobilization was considered adequate when the marginal flap portion could passively reach coronally to the CEJ at each single tooth and remain stable even without sutures. The buccal flap was coronally repositioned without tension and precisely adapted on the root surfaces. Each surgical papilla was stabilized over the interdental connective tissue bed and sling sutures were placed using 5-0 mersilk nonabsorbable sutures. [Ethicon; Johnson and Johnson PVT LTD., Jharmajri, H.P., India] A periodontal dressing was applied to protect the surgical area from mechanical injury during the initial healing phase (Zucchelli and De Sanctis, 2000)

For the control group, local anesthesia was induced, following which a tunnel was created under the buccal aspect of the gingival tissue. A sulcular partial thickness incision was placed at each recession area, undermining the tissue far beyond the mucogingival junction (MGJ) to ensure adequate relaxation of the pedicle flap and create an area for the connective tissue graft (CTG). The partial dissection was extended laterally through the papillae between the treated teeth without severing them. This incision was also extended 3 to 5 mm mesially and distally to the area of the CTG. Great care was taken when going through the MGJ to avoid perforation of the flap.

Following induction of local anesthesia, a free SECTG was harvested from the palate (premolar to molar) using the trap door technique (Harris, 1992). Transmucosal probing was used to ensure adequate connective tissue thickness, and a horizontal split thickness incision was placed approximately 4 mm from the palatal gingival margin and extended according to the mesiodistal width of the recipient site. Vertical incisions were then placed at either end of the first incision to facilitate access to the underlying connective tissue. The exposed connective tissue was harvested using a scalpel and a periosteal elevator to obtain a 1.5 to 2 mm thick graft. The flap was then repositioned to completely cover the donor site and sutured. The SECTG was immediately placed over the prepared recipient site and secured in place. The tissue flap was coronally repositioned over the graft and secured at the level of the CEJ using interdental 5-0 mersilk nonabsorbable sutures. A periodontal dressing was applied to protect the surgical area from mechanical injury during the initial healing phase (Wennström and Zucchelli, 1996)

Patients were given postoperative instructions and prescribed antibiotics (amoxicillin, 500 mg thrice a day for 7 days; Marmar and Hom, 2009) and analgesics. A 0.2% chlorhexidine rinse was prescribed for the early healing phase. Sutures were removed 2 weeks after surgery. The buccal flap usually heals without any visible surgical signs by the end of 2 postoperative weeks (Zucchelli and De Sanctis, 2000). Oral prophylaxis was performed at regular intervals, i.e., 1, 3, and 5 weeks after suture removal and every 3 months thereafter until the final follow-up. All subjects were evaluated at 3 and 6 months to record the plaque scores, bleeding scores, RD, PD, KGH, and root coverage [*Figures 1-3* (test group), *Figures 4-6* (control group)]. No patient exhibited postoperative complications.

Statistical analysis

Results are expressed as mean ± SD for each parameter. Data were analyzed using Student's *t*-test for paired and unpaired observations to assess changes within and between groups ($p < 0.05$ was considered statistically significant). All analyses were performed using SPSS software version 16.10 (SPSS Inc., IBM, Chicago, USA).

Figure 1: Test group at baseline.

Figure 2: Test group at 3 months.

Figure 3: Test Group at 6 months.

Figure 4: Control group at baseline.

Figure 5: Control group at 3 months.

Figure 6: Control group at 6 months.

Results

Mean plaque index scores significantly decreased after surgery compared with those at baseline in both groups. Mean scores in the test group decreased by 0.43 ± 0.25 after 3 months and 0.68 ± 0.24 after 6 months, whereas those in the control group decreased by 0.42 ± 0.19 after 3 months and 0.69 ± 0.21 after 6 months ($p < 0.05$ for all; *Table 1*) There were no significant differences in the decrease in mean plaque index scores between the two groups during both time intervals (*Table 4*).

Mean bleeding index scores significantly decreased after surgery compared with those at baseline in both groups. Mean scores in the test group decreased by 0.30 ± 0.32 after 3 months and 0.44 ± 0.25 after 6 months, whereas those in the control group decreased by 0.46 ± 0.43 after 3 months and 0.85 ± 0.44 after 6 months ($p < 0.05$ for all; *Table 1*). There were no significant differences in the decrease in mean bleeding index scores between the two groups during both time intervals (*Table 4*).

In the test group, the mean PD decreased by 0.05 ± 0.22 mm at 3 months compared with baseline PD (not significant). In the control group, the mean PD decreased by 0.14 ± 0.35 mm at 3 months compared with baseline PD; this decrease was statistically significant ($p < 0.05$; *Table 2*). At 6 months, the test and control groups exhibited mean decreases of 0.08 mm (not significant; $p > 0.05$) and 0.11 ± 0.31 mm (significant; $p < 0.05$), respectively (*Table 2*). There were no significant differences in the decrease in mean PD between the two groups during both time intervals (*Table 4*).

Table 1. Comparison between plaque scores and bleeding scores (mean ± standard deviation) at 3 and 6 months with those at baseline in the test (Zucchelli's technique) and control (tunnel technique with subepithelial connective tissue graft) groups.

	(n = 10)	Test		Control	
		Mean ± SD	***p* value**	**Mean ± SD**	***p* value**
Plaque scores	Baseline	1.01 ± 0.47	-	1.47 ± 0.44	-
	3 months	0.58 ± 0.29	$p < 0.01$	0.69 ± 0.15	$p < 0.001$
	6 months	0.33 ± 0.32	$p < 0.001$	0.420 ± 0.20	$p < 0.001$
Bleeding scores	Baseline	0.80 ± 0.42	-	1.16 ± 0.59	-
	3 months	0.54 ± 0.38	$p < 0.01$	0.64 ± 0.29	$p < 0.01$
	6 months	0.36 ± 0.32	$p < 0.001$	0.31 ± 0.25	$p < 0.001$

Table 2. Comparison between pocket depth, recession depth, clinical attachment level and keratinized tissue gain (mean ± standard deviation) at 3 and 6 months with values at baseline in the test (Zucchelli's technique) and control (tunnel technique with subepithelial connective tissue graft) groups.

Parameters	**Time Interval**	**Test (n = 39)**		**Control (n = 36)**	
		Mean ± SD (mm)	***p* value**	**Mean ± SD (mm)**	***p* value**
Pocket depth	Baseline	1.08 ± 0.27	-	1.17 ± 0.38	-
	3 months	1.03 ± 0.16	NS	1.03 ± 0.17	$p < 0.05$
	6 months	1.00 ± 0.00	NS	1.06 ± 0.23	$p < 0.05$
Recession depth	Baseline	2.03 ± 0.81	-	2.22 ± 0.72	-
	3 months	0.54 ± 0.82	$p < 0.001$	0.89 ± 0.71	$p < 0.001$
	6 months	0.10 ± 0.31	$p < 0.001$	0.22 ± 0.42	$p < 0.001$
Clinical attachment level	Baseline	3.08 ± 0.81	-	3.42 ± 0.73	-
	3 months	1.56 ± 0.88	$p < 0.001$	1.92 ± 0.73	$p < 0.001$
	6 months	1.18 ± 0.45	$p < 0.001$	1.31 ± 0.47	$p < 0.001$
Keratinized tissue gain	Baseline	4.74 ± 1.35	-	5.08 ± 1.34	-
	3 months	5.03 ± 1.14	$p < 0.05$	5.20 ± 1.21	NS
	6 months	5.31 ± 1.08	$p < 0.001$	5.42 ± 1.27	$p < 0.001$

Table 3. Comparison of root coverage and number of patients with complete root coverage (mean ± standard deviation) between test (Zucchelli's technique) and control (tunnel technique with subepithelial connective tissue graft) groups.

(n = 10)	Group	Mean ± SD	*p* value
Mean root coverage (%)	Test	89.33 ± 14.47	NS
	Control	80.00 ± 15.39	
Proportion of sites exhibiting complete root coverage (%)	Test	82.50 ± 23.72	NS
	Control	71.40 ± 20.93	

Table 4. Comparison of all parameters measured at baseline, 3 months, and 6 months between the test (Zucchelli's technique) and control (tunnel technique with subepithelial connective tissue graft) groups.

Parameters	Test (n = 39) Control (n = 36)	Baseline		3 months		6 months		3 and 6 months
		Mean ± SD	*p* value	Mean ± SD	*p* value	Mean ± SD	*p* value	
Recession depth (mm)	Test	2.03 ± 0.81	NS	0.54 ± 0.82	NS	0.10 ± 0.31	NS	$p < 0.05$
	Control	2.22 ± 0.72		0.89 ± 0.71		0.22 ± 0.42		$p < 0.001$
Probing depth (mm)	Test	1.08 ± 0.27	NS	1.03 ± 0.16	NS	1.00 ± 0.00	NS	NS
	Control	1.17 ± 0.38		1.03 ± 0.17		1.06 ± 0.23		NS
Clinical attachment level (mm)	Test	3.08 ± 0.81	NS	1.56 ± 0.88	NS	1.18 ± 0.45	NS	$p < 0.01$
	Control	3.42 ± 0.73		1.92 ± 0.73		1.31 ± 0.47		$p < 0.001$
Keratinized tissue gain (mm)	Test	4.74 ± 1.35	NS	5.03 ± 1.135	NS	5.31 ± 1.08	NS	$p < 0.001$
	Control	5.08 ± 1.34		5.20 ± 1.21		5.42 ± 1.27		$p < 0.01$
Plaque scores	Test	1.01 ± 0.47	NS	0.58 ± 0.28	NS	0.33 ± 0.32	NS	$p < 0.01$
	Control	1.47 ± 0.44		0.69 ± 0.15		0.42 ± 0.20		$p < 0.001$
Bleeding scores	Test	0.80 ± 0.42	NS	0.50 ± 0.53	NS	0.36 ± 0.32	NS	NS
	Control	1.16 ± 0.59		1.16 ± 0.59		0.31 ± 0.25		$p < 0.05$

At three months, the mean RD decreased by 1.49 ± 0.56 mm in the test group and 1.33 ± 0.59 mm in the control group (*Figures 2 and 5*, respectively) when compared with baseline (*Figures 1 and 4*, respectively); which were statistically significant ($p < 0.001$; *Table 2*). At 6 months, the test and control groups exhibited significant mean recession depth reduction of 1.93 ± 0.77 mm and 2.0 ± 0.72 mm, respectively ($p < 0.001$ for both groups; *Table 2, Figures 3 and 6*). However, there were no significant differences in the decrease in mean RD between the two groups during both time intervals (*Table 4*).

Both the test and control groups exhibited significant mean CAL gains of 1.52 ± 0.60 mm and 1.5 ± 0.56 mm, respectively, at 3 months and 1.89 ± 0.79 mm and 2.11 ± 0.70 mm, respectively, at 6 months ($p < 0.001$; *Table 2*). There were no significant differences in mean CAL gain between the two groups during both time intervals (*Table 4*).

The mean KGH gain at 3 months was 0.29 ± 0.69 mm in the test group (significant; $p < 0.05$) and 0.12 ± 0.42 mm in the control group (not significant; *Table 2, Figures 2 and 4,* respectively). The mean KGH gain at 6 months was 0.57 ± 0.50 mm and 0.34 ± 0.77 mm in the test and control groups, respectively *(Figures 3 and 6)*; both were statistically significant ($p < 0.001$; *Table 2*). However, there were no differences in mean KGH gain between the two groups during both time intervals (*Table 4*).

The mean percentage of root coverage was calculated using the following formula:

% root coverage = 100 × [Baseline RD − Postoperative RD]/Baseline RD

When compared from baseline the mean root coverage at 3 months was 89.33% ± 14.47% in the test group and 80.00% ± 15.39% in the control group. The proportion of defects that exhibited complete root coverage was 82.50% ± 23.72% in the test group and 71.40% ± 20.93% in the control group (*Table 3*). There were no statistically significant differences in either parameter between the two groups (*Table 4*).

Discussion

The treatment of gingival recession is becoming an important therapeutic issue from the viewpoint of esthetics. Improving esthetics during smiling or function is becoming the main aim of root coverage procedures. Gingival recession frequently affects groups of adjacent teeth. In order to minimize the number of surgeries and optimize the esthetic results, all the defects should be simultaneously treated (Zucchelli and De Sanctis, 2000). Multiple adjacent recession defects are a therapeutic challenge considering that several defects must be treated in a single surgical session to minimize patient discomfort. The CAF and the supraperiosteal envelope flap, along with its modification, the so-called tunnel technique, are most commonly employed for the treatment of multiple recessions (Jung *et al.*, 2008). The premolars and molars are the most common sites of involvement (Loe *et al.*, 1992; Serino *et al.*, 1994). However, Serino *et al.* (1994), after 12 years of longitudinal evaluation, reported that in subjects aged 18-29 years the incisors and maxillary canines were the most frequently affected by recession. Therefore, incisors, canines and premolars were selected for the present study (Wennström and Zucchelli, 1996). Cigarette smoking may affect the short-term outcome of root coverage procedures and should be carefully considered when planning periodontal plastic surgery (Luiz and Leandro, 2006). Therefore, our study included only nonsmokers. All root surfaces in our study were conditioned with tetracycline HCL in accordance with a report by Isik *et al.* (2000) indicating that a 50-150 mg/ml tetracycline HCL solution resulted in a statistically significant opening of dentinal tubules.

Among the various treatment modalities, variations of SECTG procedures demonstrate high predictability with a high percentage of root coverage and a low complication rate. Root coverage achieved with SECTG procedures remains stable over the long term. Therefore, SECTG procedures are used as a "gold standard" for the evaluation of the safety and efficacy of new root coverage procedures (Jung *et al.*, 2008). However, SECTG is most commonly used in combination with CAFs, which necessitate buccal vertical incisions and consequently retard early esthetic results. Therefore, the envelope (tunnel) technique, which results in quick early healing by eliminating the need for vertical incisions, was advocated (Zabalegui *et al.*, 1999).

To our knowledge, no studies have evaluated the prevalence of single versus multiple recessions in patients with esthetic demands. Very little data regarding the treatment of multiple recession defects are available, and no data comparing the two procedures employed in this study are available. Moreover, there are less data on the use of SECTG procedures for the treatment of multiple recession defects. "Lack of popularity may be attributed to increased patient discomfort caused by the harvesting of large grafts from the palate. Furthermore, larger grafts impair the vascular exchange between the covering flap and the underlying recipient bed, thus increasing the risk of flap dehiscence and causing unesthetic graft exposure" as stated by Zucchelli *et al.* in his classical study in 2009. Therefore, we aimed to elucidate the effectiveness of Zucchelli's technique in this study using SECTG procedures as the control.

The importance of tooth brushing technique for the long-term maintenance of clinical outcomes achieved by root coverage procedures has been demonstrated. Patients in this study were instructed and motivated to perform a coronally directed roll technique to minimize toothbrush trauma and achieve optimal plaque control (Wennström and Zucchelli, 1996). Because of this constant motivation, plaque and bleeding scores significantly decreased over the follow-up period in both groups. This is in accordance with the study of Wenstrom and Zucchelli (1996), where it was indicated that an altered nontraumatic toothbrushing technique was crucial for achieving successful outcomes of root coverage procedures.

In the present study, mean PD and RD significantly decreased while mean CAL and KGH significantly increased 6 months after surgery in both the test and control groups. Furthermore, statistically significant root coverage was obtained in both groups, and the proportion of defects with complete root coverage was also statistically significant in both groups. With regard to the test group, all these outcomes were similar to those reported in 1-year and 5-year studies (the latter was a continuation of the former) by Zucchelli and De Sanctis (2000) in another study by Zucchelli and De Sanctis (2005). However, the outcomes in these studies were evaluated after a longer follow-up period of (minimum 1 year). Therefore, our study showed results within 6 months when compared to these studies, which were followed for 1 to 5 years.

With regard to the control group, there is no concrete data available concerning an increase in CAL and a decrease in PD and RD associated with the tunnel technique with SECTG placement for the treatment of multiple recession defects. However, it is interesting to note that there was no significant difference in any of the parameters evaluated 6 months after surgery between the test group and the control group in the present study, although the mean percentage of root coverage and the number of patients with complete root coverage were slightly higher in the test group than in the control group.

When comparing two different techniques, a split mouth study design would have been ideal (Zucchelli technique on one side and SEGTG technique on the other. However, tissue shrinkage is different with different techniques. Also, different people have different wound healing potential and it would compromise the overall esthetics in such esthetic-oriented studies. Thus we avoided split mouth design and used a parallel design in our study. This has been mentioned as one of the limitations of our study.

The fact that the coronally advanced procedure resulted in an increased apicocoronal gingival height may be explained by several events taking place during healing and maturation of the marginal tissue. First, there is a tendency of the mucogingival line to regain its genetically defined position following coronal dislocation during the flap procedure, and second, it cannot be excluded that granulation tissue derived from the periodontal ligament tissue may have contributed to the increased gingival dimensions.

Taken together, the present study demonstrated that the proposed modification of the CAF, i.e., Zucchelli's technique, is effective for the management of multiple recession defects affecting adjacent teeth in the esthetic regions of the mouth. This new modification does not involve a palatal donor site and has been demonstrated to be a safe and predictable approach (Zucchelli and De Sanctis, 2000). Multiple gingival recessions involving teeth in the esthetic areas of the mouth have been successfully treated using this technique (Zucchelli and De Sanctis, 2000). In addition, root coverage and esthetic outcomes have been reported to be well maintained in the long term (5 years) in patients using a correct, non-traumatic, toothbrushing technique (Zucchelli and De Sanctis, 2005) The presumed advantage of this technique is the use of a flap without vertical releasing incisions, which could otherwise damage the lateral blood supply to the flap and result in unesthetic visible scars (keloids; Joly *et al.*, 2007).

On the other hand, procedures involving SECTG placement require autogenous grafts, which results in the creation of a second wound site, longer chair time, higher possibility of tissue morbidity, and intra- and/or postoperative discomfort, all of which can lower patient acceptance (Terrence *et al.*, 2006). Another possible explanation for the improved results in our study may be the strict entry criteria. Only Miller's class I and II defects with no deep cervical abrasion or root demineralization were included. Yet another explanation could be the design of the envelope flap, which involves extension of the flap to one tooth mesial and distal to the affected teeth. This influences the soft tissue margins of the neighboring teeth, thus resulting in a more harmonious, scalloped, knife-edged outline of all teeth belonging to the quadrant jaw.

Limitations of our study include its short-term follow-up period (6 months), unlike the previous studies (Zucchelli and De Sanctis, 2000 and 2005; Zucchelli *et al.*, 2009). A longer period of evaluation may be necessary in future clinical trials to appreciate the clinical effectiveness of this technique and to evaluate its long-term benefits. Also, our study included Miller's class I and II recession defects with an average depth of 2 mm. Moreover, we used a parallel design of study; in comparative clinical trials a split-mouth design would have been more appropriate to evaluate the response to different techniques in the same patient.

Conclusion

Both the techniques employed for the treatment of multiple recession defects in this study demonstrated effective results in terms of both root coverage and increase in KGH. Root coverage could be achieved irrespective of the number of recessions and the presence or absence of a secondary surgical intervention. However, the advantages of Zucchelli's technique (modification of the CAF) overpower the advantages of the tunnel technique with SECTG placement. The former technique makes treatment easy for both the clinician and the patient being treated (Zucchelli and De Sanctis, 2000). Further long-term, multi-center clinical trials with split-mouth designs comparing Zucchelli's technique with different techniques and analyzing the histology of the attachment achieved are warranted to provide conclusive evidence.

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