

Original Article

Effect of microsurgical technique for root coverage using modified coronally advanced flap with connective tissue graft- Randomized controlled clinical trial

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ABSTRACT

Background: The aim of the study was to compare the root coverage percentage and other clinical outcomes in Millers Class I and Class II gingival recessions (GR) treated with modified coronally advanced flap (MCAF) combined with connective tissue graft (CTG) using macro and microsurgical approaches.

Materials and Methods: In this controlled clinical trial, a total of 32 Miller's Class I and Class II GR defects were randomly assigned to the control and test groups (16 in each group). All the patients were treated with MCAF with CTG as the root coverage procedure. For the control and test groups, the procedure was performed using a macro and microsurgical approach, respectively. Clinical parameters were assessed at baseline and in 6th month. Wilcoxon signed-rank test was used to compare the values between baseline and 6 months. Statistical significance was set at $P < 0.05$. 1 week after surgery, wound healing index (WHI) and Visual Analog Scale (VAS) scores were recorded.

Results: Intragroup comparisons revealed significant improvement in all the parameters in both the groups at 6 months. The proportion of root coverage achieved in the control and test groups was 78% and 86%, respectively. At 6 months, the root coverage percentage between the study groups showed no significant difference ($P = 0.207$). Intergroup analysis of WHI and VAS scores showed better healing and less postoperative pain in the microsurgical group compared to macrosurgical group ($P < 0.05$).

Conclusion: At 6 months, there were no significant differences in root coverage percentage or other clinical parameters between the groups based on whether a macro or microsurgical method was used. However, better wound healing, less pain, and discomfort were observed in the microsurgical group.

Key Words: Connective tissue, gingival recession, microsurgery, surgical flaps

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INTRODUCTION

Gingival recession (GR) creates significant esthetic concerns for the patients and the genuine challenge faced by the clinicians is to obtain complete

root coverage (CRC) with predictable long-term outcomes. Literature evidence greatly supports

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the use of coronally advanced flap (CAF) for optimal root coverage.^[1,2] Bioactive grafts can be used in conjunction with CAF to augment clinical outcomes.^[3,4]

De Sanctis and Zucchelli performed a modification of the CAF which involved split-full-split thickness flap elevation along with oblique releasing incisions.^[5-7] This technique was effective in achieving CRC and the clinical results were retained over a period of 3 years. In the current scenario, less invasive root coverage techniques are preferred and the use of a surgical operating microscope has made this a reality.

Connective tissue graft (CTG) has superior predictability with optimal tissue integration at the recipient site clinically and is considered the gold standard for root coverage. Robust evidence supports the fact that isolated or multiple GR using modified CAF (MCAF) with CTG is associated with maximum probability for CRC. Studies have clearly established that periodontal plastic surgical procedures designed for root coverage and performed under a surgical microscope, enhanced the treatment outcomes at a clinically significant level when compared to conventional or macrosurgical approach.^[8]

Taking all these factors into consideration, the goal of this present prospective randomized controlled clinical trial was to compare the root coverage percentage and other clinical outcomes in Miller's buccal Class I and Class II GR treated with MCAF combined with CTG using macro and microsurgical approaches.

MATERIALS AND METHODS

This prospective comparative clinical study was conducted in our department of periodontics and the study design was approved by the Institutional Ethical Committee and Scientific Review Board with the approval number (IRB NO: SRMDC/IRB/2017/MDS/NO: 507). The trial was registered in the clinical trial registry India and the provisional number is REF/2019/08/027850. The nature of the study explained, and informed consent was obtained from patients who were willing to participate in the study.

Sample size calculation

The sample size was calculated based on the results obtained from Burkhardt R, Lang NP 2005 with 5% alpha error and 90% power.^[9] The required sample

size was 32 patients with 16 patients in each group. Expecting a 10% dropout during the follow-up period, a total of 36 patients were recruited at the onset.

Inclusion and exclusion criteria

Patients with one or more Miller's Class I and Class II buccal recessions demonstrating $\leq 20\%$ of plaque and bleeding scores, respectively, after Phase I therapy were included.^[10] Smokers, patients with malposed or crowded teeth, pregnant and lactating women, patients using medications that could affect the periodontal status were excluded from the study.

A total of 32 patients presenting with Miller's Class I and Class II GR defects satisfying the selection criteria were randomized into the control and test groups with 16 patients in each group. MCAF with CTG was performed for both groups. Macrosurgical approach was performed for the control and microsurgical approach for the test group. Full mouth plaque scores (FMPS),^[11] full-mouth bleeding scores (FMBS),^[12] probing pocket depth (PPD), clinical attachment level (CAL), Assessment of Relative gingival position at the surgical site (RPGM), recession depth (RD), recession width (RW), width of attached gingiva (WAG), width of keratinized mucosa (WKM), and percentage of root coverage based on RD were recorded with the help of a UNC (University of North Carolina) 15 periodontal probe using a customized composite stent and the measurements were rounded off to the nearest mm.

The recruited sites for the study were randomized based on simple randomization by taking the last digit of the outpatient card number. The patient with odd number was allocated to the control group and with even number for the test group by an investigator (S.S). The allocation of specific treatment was concealed in sealed opaque envelopes, with the patients' name written on it which was opened only at the time of surgery. All the surgical procedures were done by a single experienced operator (P.P.S.G). The examiner (D.A) who evaluated the clinical parameters at baseline and at 6 months was blinded to the surgical intervention [Figure 1].

Surgical procedure

The operative site was anesthetized using 2% lignocaine HCl with adrenaline at 1: 80,000 and MCAF technique (Zuchelli's technique) was used to elevate flap. Two horizontal beveled incisions located at a distance from the tip of the interdental papillae

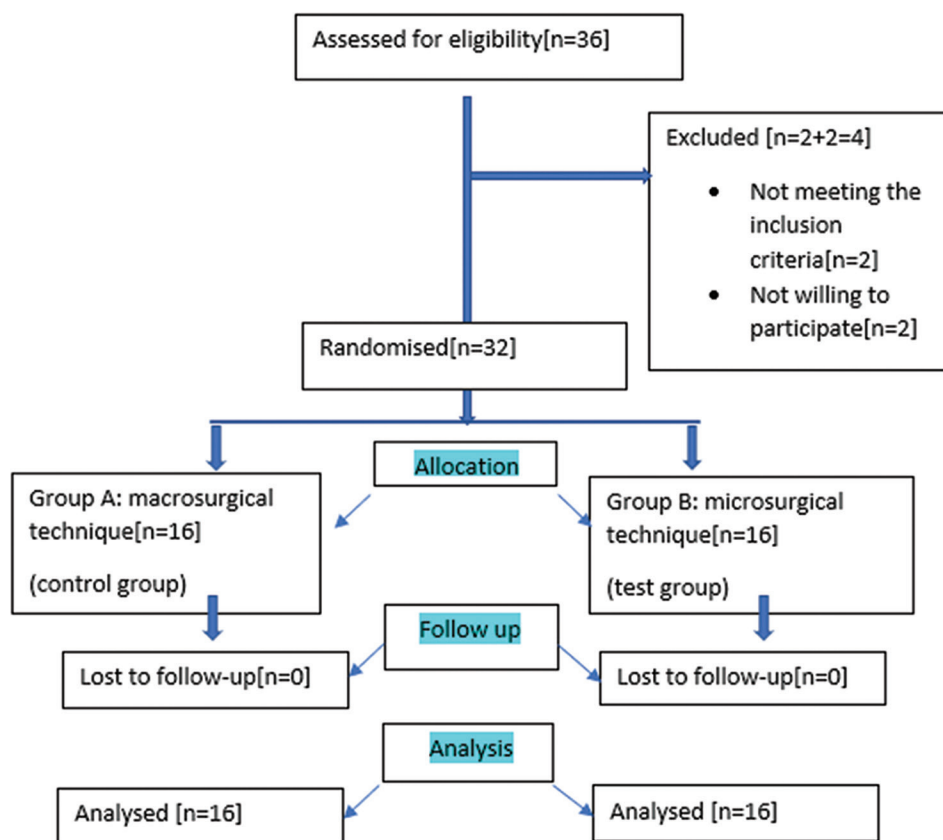


Figure 1: CONSORT Flow chart.

were given mesially and distally to the recession defect. Two slightly divergent beveled oblique incisions were subsequently made, starting at the end of the two horizontal incisions and extending to the alveolar mucosa. The resulting trapezoidal-shaped flap was raised with a split–full–split approach in the coronal–apical direction. Coronal mobilization of the flap was deemed sufficient when the marginal portion of the flap could passively reach a level coronal to the cemento-enamel junction of the tooth with the recession defect.

For the microsurgical procedure, instruments included microsurgical blade MB67 and handle (Hu-Friedy, USA), microsurgical elevator (Hu-Friedy, USA), microsurgical castroviejo needle holder and scissors, microsurgical suction tip. The graft and flap were secured using resorbable 6-0 Vicryl sutures. The surgical procedure was performed under a surgical microscope with $\times 10$ magnification. For the macro-surgical approach, instruments including 15c BP blade and handle, periosteal elevators, surgical needle holder, scissors, suction tip, and resorbable 5-0 Vicryl sutures were used. The palatal graft harvesting, as well as the buccal recession coverage,

was performed under normal vision without optical magnification [Figures 2 and 3].

Connective tissue graft harvesting

The CTG was harvested from the palate by a single incision technique. The region from which the CTG was harvested extends from the distal of canine to the mesial of first molar. The obtained graft was trimmed to remove the fatty glandular tissue and make a uniform thickness of 1–1.5 mm. The incision was approximated with simple interrupted sutures.

After the preparation of the recipient site, CTG obtained from the palate was placed at the surgical site. Recipient and donor sites were sutured, and periodontal dressing was given.

Postoperative protocol

Patients were prescribed analgesics for 2 days and were instructed not to brush the operated area for about a week. In addition, 0.2% chlorhexidine mouthwash was recommended for 2 weeks. The sutures were removed after 7 days and then the wound healing and visual analog scale (VAS) were assessed. Wound healing index (WHI) was assessed using WHI given by Huang *et al.* in 2005 at 1 week

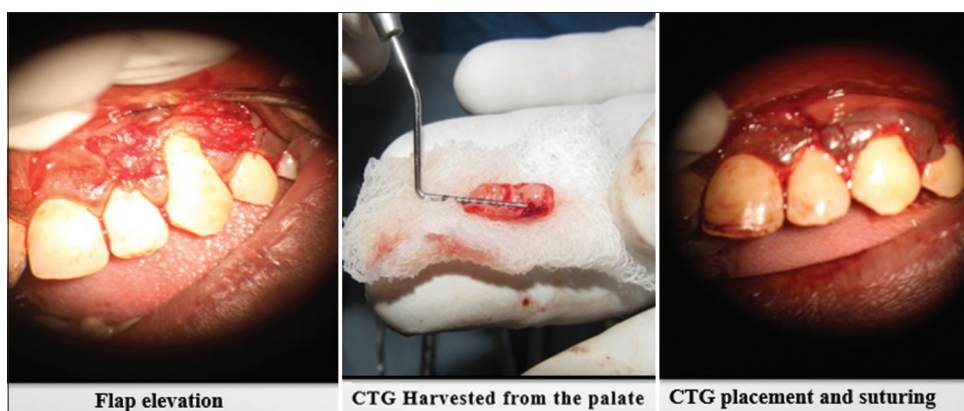


Figure 2: Surgical protocol for test group. CTG: Connective tissue graft.

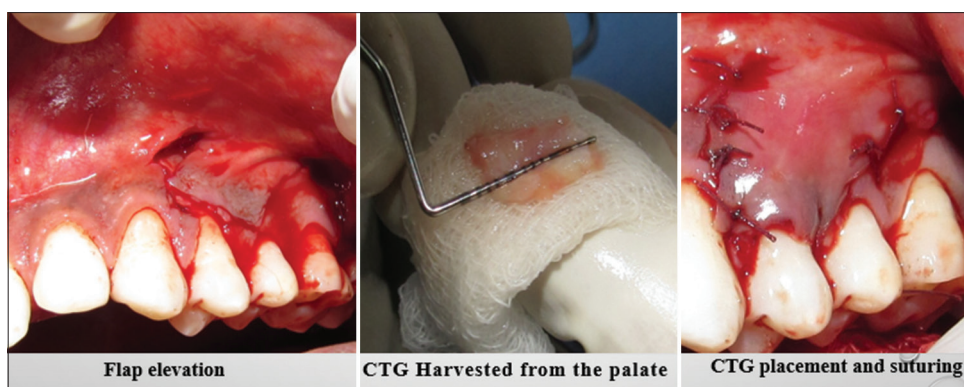


Figure 3: Surgical protocol for control group. CTG: Connective tissue graft.

postoperatively.^[13] The scoring criteria are as follows: Score 1-Uneventful healing with no gingival edema, erythema, suppuration, patient discomfort or flap dehiscence. Score 2-Uneventful healing with slight gingival edema, erythema, patient discomfort or flap dehiscence but no suppuration. Score 3-Poor wound healing with significant gingival edema, erythema, patient discomfort, flap dehiscence or suppuration. All other clinical parameters were reassessed after 6 months [Figures 4 and 5].

Statistical analysis

Independent samples *t*-test was applied for intergroup comparison of age, FMPS, FMBS, WAG, WKM, RPGM, root coverage percentage and WHI. To compare mean values between baseline and 6 months paired *t*-test was applied. To compare proportions between study and control groups Chi-square test was applied, if any expected cell frequency was less than five then Fisher's exact test was used. Variables such as RD, RW, PPD, CAL(Clinical attachment level), and VAS pain scale did not follow Normal distribution and hence to compare these variables between the groups, Mann-Whitney test was applied.

Wilcoxon Signed-Rank test was used to compare values between baseline and 6 months. To analyze the data SPSS (IBM SPSS Statistics for Windows, Version 25.0, Armonk, NY, USA: IBM Corp. Released 2017) was used. Significance level was fixed as 5% ($\alpha = 0.05$).

RESULTS

A total of 36 patients were enrolled for the study. Four of them were excluded as two of them did not meet the inclusion criteria and two of them were not willing to give consent to participate in the study. Thus the remaining 32 patients were randomly allocated into the control and the test groups with 16 patients in each group. None of them were lost to follow up after randomization and all 16 patients in each group were subjected to baseline and 6th month statistical analysis to assess the primary outcome [Figure 1].

Descriptive statistics of patients at baseline is given in Table 1 and the results indicated that these variables did not demonstrate significant differences between the study groups at baseline.



Figure 4: Baseline and 6 months photographs of test group.

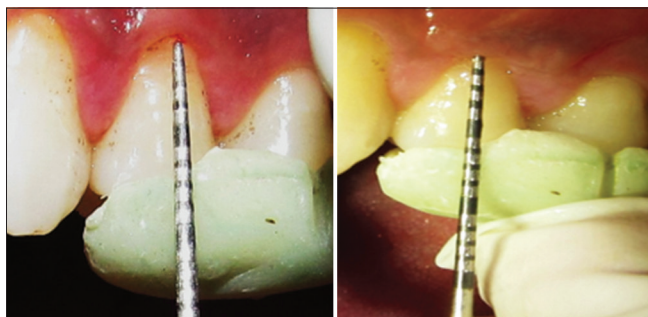


Figure 5: Baseline and 6 months photographs of the control group.

The clinical parameters of the control and test groups were compared at baseline and 6 months. In both study groups, there was a statistically significant improvement in all clinical parameters with a $P = 0.001$. At the end of 6 months, clinical parameters were compared between groups. In the test group, clinical parameters like RD, RW, RCP (Root coverage percentage), CAL, PPD, WAG, WKM, RPGM slightly improved than the control group. However, no statistical significance was observed for any of the clinical parameters tested between the test and control groups [Table 2].

The comparison of WHI and VAS pain scores between test and control groups at 1 week indicated that there was significant improvement in early wound healing and lower VAS pain scores in the test group compared to the controls ($P \leq 0.05$).

Table 3 shows the comparison of mean difference of clinical parameters of both test group and control group at 6 months. In the test group, mean difference in clinical parameters like RD, RW, CAL, PPD, WAG, WKM, RPGM were slightly improved than the control group. However, no statistical significance was observed in the mean difference for any of the clinical parameters between the test and control groups. Postoperative discomfort of the donor site was experienced by patients in both the study groups.

Table 1: Descriptive statistics of patients at baseline

Variables	Macrosurgical approach (control group)	Microsurgical approach (test group)	<i>P</i>
Age	42.69±9.336	38.50±8.124	0.186
Gender (%) [‡]			
Male	68.8	81.3	0.685
Female	31.3	18.8	
FMPS (%) [*]	18.173±1.69	17.97±1.96	0.763
FMBS (%) [*]	15.90±2.144	16.38±2.14	0.533
RD (mm) [#]	2.25±0.58	2.56±0.81	0.369
RW (mm) [#]	2.75±0.45	3.06±0.57	0.104
PPD (mm) [#]	1.94±0.44	1.63±0.50	0.075
CAL (mm) [#]	4.19±0.83	4.13±0.81	0.804
RPGM (mm) [*]	7.13±1.857	7.81±2.198	0.347
WAG (mm) [*]	3.06±0.854	3.31±1.352	0.537
WKM (mm) [*]	5.00±0.730	4.63±1.025	0.243

[‡]Chi-square test; ^{*}Independent sample *t*-test; [#]Mann-Whitney test. FMPS: Full mouth plaque score; FMBS: Full-mouth bleeding score; RD: Recession depth; RW: Recession width; PPD: Probing pocket depth; CAL: Clinical attachment level; RPGM: Relative position of gingival margin; WAG: Width of attached gingiva; WKM: Width of keratinized mucosa

In the recipient site, the pain perception of the patients was greater in the control group compared to the test group. Three patients in the control group had swelling of the recipient site and one of them had slight flap dehiscence of wound during the 1st week of surgery.

DISCUSSION

The scientific data on root coverage procedures indicated that root coverage procedures performed with CAF and CTG provided remarkable esthetics and also favorably regulated the parameters associated with root coverage.^[2,14,15] In the present study the surgical technique employed for root coverage involved split-full-split thickness flap elevation with CTG as the biomatrix. Early WHI revealed that wound healing is significantly better in the microsurgical group compared to the macrosurgical group.^[13] This finding is attributed to precise incisions and approximation that was made possible in the microsurgery group for the wound to heal without any dehiscence. Postoperative pain and discomfort of the treatments assessed using VAS showed that the patients felt more relaxed with significantly less pain in the microsurgical group.

Both the study groups demonstrated significant improvement in RD from baseline to 6 months. However, when the control and test groups were examined after 6 months, no significant

Table 2: Comparison of clinical parameters at baseline and 6 months between the study groups

Variables	Control group	Test group	P
RD (mm)			
Baseline	2.25±0.58	2.56±0.81	0.240
6 months	0.53±0.59	0.34±0.60	
P	<0.001	<0.001	
RW (mm)			
Baseline	2.75±0.45	3.06±0.57	0.465
6 months	1.00±1.10	0.75±1.18	
P	<0.001	<0.001	
PPD (mm)			
Baseline	1.94±0.44	1.63±0.50	0.353
6 months	1.56±0.73	1.31±0.48	
P	<0.001	<0.001	
CAL (mm)			
Baseline	4.19±0.83	4.13±0.81	0.221
6 months	2.03±0.88	1.66±0.75	
P	<0.001	<0.001	
RPGM (mm)			
Baseline	7.13±1.857	7.81±2.198	0.771
6 months	5.40±1.71	5.594±1.89	
P	<0.001	<0.001	
WAG (mm)			
Baseline	4.81±1.223	3.31±1.352	0.806
6 months	4.94±1.611	4.94±1.611	
P	<0.001	<0.001	
WKM (mm)			
Baseline	5.00±0.730	4.63±1.025	0.799
6 months	6.38±1.025	6.25±1.653	
P	<0.001	<0.001	
RCP (%), 6 months	76.51±24.84	86.97±20.85	0.207
Wound healing index, 1 week	1.63±0.5	1.25±0.577	0.059*
VAS pain scale, 1 week	2.56±1.59	1.06±0.93	0.008*

*P≤0.05 statistically significant. RD: Recession depth; RW: Recession width; PPD: Probing pocket depth; CAL: Clinical attachment level; RPGM: Relative position of gingival margin; WAG: Width of attached gingiva; WKM: Width of keratinized mucosa; VAS: Visual Analog Scale; RCP: Root coverage percentage

Table 3: Intergroup comparison of mean difference of all clinical parameters at 6 months

Variables	Control	Test	P
RD (mm)	1.718±0.54	2.218±0.87	0.0772
RW (mm)	1.75±1.18	2.312±1.07	0.1828
PPD (mm)	0.375±0.71	0.312±0.54	0.0852
CAL (mm)	2.156±0.70	2.468±0.76	0.2643
RPGM (mm)	1.719±0.54	2.218±0.87	0.0638
WAG (mm)	1.75±0.77	1.625±0.95	0.6877
WKM (mm)	1.375±0.95	1.625±1.08	0.4955

RD: Recession depth; RW: Recession width; PPD: Probing pocket depth; CAL: Clinical attachment level; RPGM: Relative position of gingival margin; WAG: Width of attached gingiva; WKM: Width of keratinized mucosa

differences were detected. Various studies that used a microsurgical approach for root coverage with different techniques reported an improvement in RD of about 2–2.5 mm.^[9,16,17] These observations were

in accordance with the findings of the present study which documented an improvement of 2.2 mm in RD. The mean reduction in RD at 6 months for the macrosurgical group in our study was 1.71 mm which was similar to earlier studies that used macrosurgical approach as the control group.

The mean percentage of root coverage at 6 months in the control group was 76.51 ± 24.84%, whereas in the test group, it was 86.97 ± 20.85%. Although a higher percentage of root coverage was demonstrated with the microsurgical approach, a significant difference was not observed between the study groups. Various other studies that used CTG as the biomatrix also demonstrated favorable results in the microsurgical group with a mean root coverage percentage between 86% and 98%, whereas in the macrosurgical group, their mean RCP ranged from 78% to 90%.^[9,16,18] Collectively, it was indicated that the microsurgical approach offers better root coverage clinically when compared to the macrosurgical approach. However, none of the studies that used microsurgical approach for root coverage with CTG as biomatrix demonstrated significant differences from macrosurgical approach in terms of RD reduction and root coverage percentage.^[9,16,18]

In the current study, 11 out of 16 patients in the test group obtained CRC, whereas only 7 out of 16 patients in the control group did, which is approximately 68% and 43% in the test and control groups, respectively.

Although RW, PPD, CAL, WAG, WKM, and relative position of gingival margin reduced from baseline to 6 months in both the groups, these parameters did not show a significant difference between the study groups at 6 months. The mean gain in the relative position of gingival margin was 1.7 mm in the control group and 2.2 mm in the test group which was reflected in the exact RD reduction of control and test groups with regard to the present study.

The microsurgical procedure allowed high magnification and greater precision in the handling of the tissues. This could explain the better clinical outcomes and reduced pain perception of patients in the microsurgical group. However, it was observed in the study that the surgical time taken for the test group is longer compared to the control group.

The limitations of the study are smaller sample size with a shorter follow-up period of only 6 months. The present study observations indicate that both

micro and macrosurgical approaches were able to provide a good amount of root coverage by using MCAF and CTG. The microsurgical approach is definitely better to the macrosurgical approach in terms of clinical improvements and the number of CRC. However, significant difference in the parameters could not be demonstrated between the study groups at 6 months. Nonetheless, when wound healing and patient-centered outcomes are taken into account, microsurgical treatment may be preferable to macrosurgical approach since it has more substantial impacts. Therefore, within the limits of the current study, it is concluded that there is no significant difference between the microsurgical approach and macrosurgical approaches in terms of root coverage percentage and related clinical parameters for MCAF technique with CTG at 6 months. Further studies with a longer follow-up period are necessary to confirm the predictability of this approach.

CONCLUSION

Based on the study results, the root coverage percentage is slightly better in the microsurgical approach however not significant at 6 months. Nevertheless, there is better wound healing response, pain and discomfort levels in the microsurgical group compared with macrosurgical group.

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Conflicts of interest

The authors of this manuscript declare that they have no conflicts of interest, real or perceived, financial or nonfinancial in this article.

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