

Clinical Evaluation of Laterally Moved Coronally Advanced Flap for Isolated Gingival Recession Coverage: A Modified Surgical Approach

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ABSTRACT

Background: Various modifications of lateral sliding flap to reduce risk of gingival recession at the donor tooth site have been proposed in literature but with low predictability of root coverage. The objective of present study was to clinically evaluate the amount of soft tissue coverage achieved with laterally moved coronally advanced flap, a modified surgical approach given by Zucchelli et al 2004.

Materials and Method: 20 isolated gingival recessions (miller class I or II) with specific features of keratinized tissue lateral to the defect were treated with a new approach to the laterally moved flap given by Zucchelli et al 2004. Clinical evaluation was made at 1 year after surgery.

Results: After 12 months examination the percentage of root coverage obtained by laterally moved coronally advanced flap was 84.0 ± 0.15 . A significant reduction in recession depth and width, gain in clinical attachment level and gain in height of keratinized tissue at recipient/treated teeth was observed from baseline to 12 months period ($p < 0.0001$).

Conclusion: The laterally moved coronally advanced surgical technique is very effective in treatment of isolated gingival recession cases when ideal gingival conditions present lateral to recession defect.

Keywords: Esthetics; gingival recession / surgery; surgical flaps; periodontal; tooth root.

INTRODUCTION

Need for improved dental aesthetics have increased tremendously in recent times making it an integral part of periodontal treatments. Many patients seek to dental treatment for their esthetics concern one of which is gingival recession. Gingival recession creates a functional deformity by destruction of the attached gingiva. The predictable coverage of denuded roots with keratinized gingiva has been one of the goals of periodontal surgery. Considerable knowledge has been gained in the surgical management of gingival recession since Grupe and Warren (1956) described the lateral

sliding flap which offers many advantages over other surgical procedures such as colour and morphology of the positioned tissue blend with the healed surgical site, and does not require a separate surgical site for obtaining a graft but sometimes gingival recession of the donor site tends to occur in this technique.

The coronally advanced flap is the first choice surgical technique when there is adequate keratinized tissue apical to recession defect.¹ optimum root coverage results and good color

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blending of the treated area with respect to adjacent soft tissue are advantages of this surgical approach.¹ But some unfavorable local anatomic conditions may render the coronally advanced flap contraindicated: 1) the absence of keratinized apical to recession defect, 2) the presence of gingival cleft, 3) the marginal insertion of frenuli, or 4) the presence of very shallow vestibule.²

To overcome above mentioned limitations of Lateral positioned pedicle graft and coronally advanced flap technique, Zucchelli et al. (2004)² given the technique of a laterally moved and coronally advanced flap for the treatment of gingival recession. The goal of the present study is to evaluate the effectiveness of this modified technique of the laterally moved flap procedure for treating isolated recession defects with respect to root coverage.

MATERIALS AND METHODS

Materials and methods pertaining to this study have been described as follows:

Selection of patients:

The present clinical study included 20 individuals (11 males and 9 females) selected from patients referred to the Department of Periodontia, Govt. Dental College and Hospital, Ahmedabad, who demonstrated at least one Miller's Class-I or Class-II gingival recession on labial aspect of anterior teeth (Recession depth $\geq 2\text{mm}$). Cooperative and Systemically healthy subjects (age ranges from 22 to 40 years) with acceptable oral hygiene were included in this study.

The most important inclusion criteria reveals: Patients with Lateral keratinized tissue width at donor site should be at least 6 mm greater than the width of the recession measured at the level of cement-enamel junction (CEJ), and Lateral keratinized tissue height at donor site is at least 2mm greater than the buccal probing depth of the adjacent tooth/teeth.

Clinical Parameters:

At baseline and throughout the study the Gingival index (Loe and Sillness 1963) and Plaque index (Turesky – Gilmore – Glickman Modification of the

Quingley Hein Plaque Index 1970) were used to monitor oral hygiene and gingival health conditions

A stent was used that acts as a fixed point at the level of cemento-enamel junction to make accurate measurements of gingival recession with the help of UNC-15 probe (EDGE CE C 15), both pre-operatively and post-operatively. The following measurements were taken at the midline of the facial aspect of the tooth at baseline and 12 months postoperatively.

Recession depth: Measured from the CEJ to the most apical extension of the gingival margin.

Recession width: Measured at the level of CEJ

Probing depth: At treated and donor teeth, measured from the gingival margin to the bottom of the gingival sulcus.

Clinical attachment level: Measured from the CEJ to bottom of the gingival sulcus of the treated tooth.

Keratinized tissue height at treated (KTH) and donor (KTH donor) teeth: Measured from the most apical extension of gingival margin to mucogingival line.

Percentage of root coverage: Obtained by using following formula,

$$\frac{\text{Pre operative recession length} - \text{Post operative recession length}}{\text{Pre operative recession length}} \times 100\%$$

Pre operative recession length

Experimental protocol:

Initial therapy consisted of oral hygiene instructions. Scaling and root planing was done prior to surgical therapy. Patients were asked to change their toothbrush and were instructed to use Modified Stillman's method for cleaning in areas with gingival recession. An appointment for the surgical procedure generally was arranged 7 to 10 days after the initial procedure. At the pre-operative examination, the teeth demonstrating recession was examined with respect to soft tissue parameters as mentioned above.

Surgical Technique:

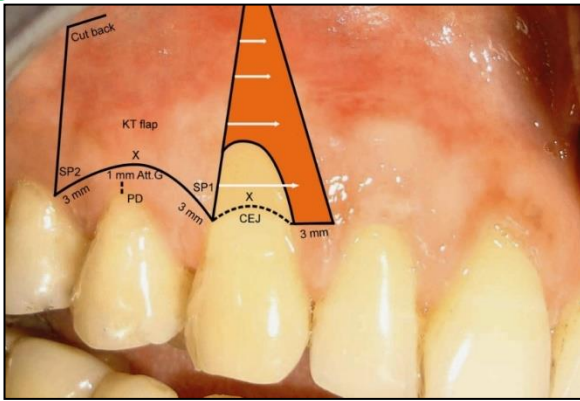


Fig 1: Schematic of the Laterally moved coronally advanced surgical technique. Legend: dotted line, receiving area for flap; x, recession width; SP, surgical papilla (3 mm wide); at G, attached gingiva; PD, probing depth.

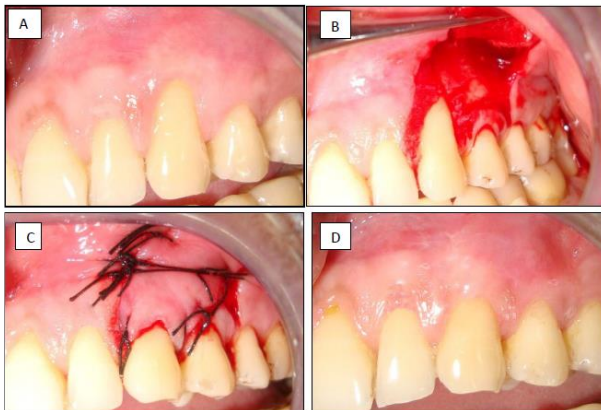


Fig: 2 a) Preoperative view, gingival recession present at tooth #13, b) After flap reflection, c) Sutures in place, d) One year post operative clinical view.

Recipient area:

After giving adequate anesthesia, the recipient area for the laterally moved flap was prepared. The flap recipient area resulted from the de-epithelialization of a triangular-shaped area delimited by three incisions:

- 1) A horizontal incision (extended 3 mm in the mesial-distal direction) at the level of the CEJ,
- 2) A vertical beveled incision, parallel to the mesial gingival margin of the recession, extending in alveolar mucosa,

3) A beveled intrasulcular incision along the distal gingival margin of the recession defect and extending in alveolar mucosa up to crossing the preceding vertical incision.

The deepithelialization of this area was performed with a 15c Bard Parker blade kept parallel to the external gingival surface; a 3 mm-wide connective tissue area lateral and apical to the root exposure provided anchorage bed to the laterally moved flap.

Flap area:

The flap design consisted of three incisions:

- a) The beveled intrasulcular incision, which is the same as incision 3 of the recipient area.
- b) A horizontal sub marginal incision extending in the mesiodistally direction 6 mm more than the width of the recession defect measured at the CEJ.

(The outline of the horizontal incision varied based on the need to preserve at least 1 mm of non-probable keratinized tissue at the adjacent donor tooth/teeth and include at least a 1 mm band of keratinized tissue all along the mesiodistally extension of the flap).
- c) A beveled oblique vertical incision, extending into alveolar mucosa, parallel to the first intrasulcular incision (incision a).

When the flap was moved in the distal-mesial direction (opposite to the direction of the lip muscle insertions) another short horizontal incision was performed at the most apical extension of this vertical incision (cut back) in order to facilitate mesial mobilization of the flap.

The flap was elevated mix thickness. During flap elevation, the thickness of the flap varied depending on the thickness required for the central portion of the flap covering the avascular root surface with respect to the most peripheral 3 mm extended area (the surgical papillae) covering the connective tissue beds prepared laterally to the root exposure (deepithelialized anatomic papillae). Once the mucogingival line was reached, flap elevation was continued split-thickness, keeping the blade parallel to the bone surface, to expose at least 5 mm of periosteum apical to the bone dehiscence of the tooth with the recession defect.

Flap elevation was terminated when it was possible to passively move the flap laterally above the exposed root. In order to allow coronal advancement of the flap, all muscle insertions present were eliminated. This was done keeping the blade parallel to the external mucosal surface.

Coronal mobilization of the flap was considered adequate when the marginal portion of the flap was able to passively reach a level coronal to the cemento-enamel junction. The flap should be stable in its final coronal position even without the sutures.

Root planing was done. The remaining facial soft tissue of the anatomic interdental papillae was deepithelialized to create connective tissue beds to which the surgical papillae of the laterally moved, coronally advanced flap were sutured.

Suturing:

The suturing began with 4-0 silk sutures (Ethicon), two interrupted periosteal sutures in the most apical extension of the vertical releasing incisions, and then proceeded coronally, along the mesial vertical incision, with other interrupted sutures, each of them directed from the flap to the adjacent buccal soft tissue in the apical-coronal direction. More apically a horizontal double mattress suture was placed to reduce lip tension on the marginal portion of the flap. A piece of dry tin foil was placed over the sutures. Surgical dressing (non-eugenol periodontal dressing, Coe-pak-GC) was applied over the operated area.

Post-operative protocols:

Routine post operative instructions were given. Systemic antibiotics (Cefadroxil 500mg twice daily for seven days) and anti-inflammatory analgesic (Ibuprofen 400 mg) was prescribed 8 hourly. 0.2% chlorhexidine mouth rinses twice a day for 4 weeks. Patients were advised to refrain from brushing at the surgical site till the periodontal dressing was in place.

After removing periodontal dressing, brushing was avoided at the treated site. Instead cotton pellet was used to clean and slightly comb the area in an apical to incisal direction for the next 4 weeks. Sutures and Surgical dressing were removed 10 days after

surgery. Patients were seen at 3 months, 6 month, 9 months and 12 months postoperatively.

All the clinical parameters i.e. length of exposed roots, width of exposed roots and width of keratinized gingiva were recorded, pre-operatively and post-operatively at 12 months.

Statistical analysis:

The information gathered from the present study was tabulated and analyzed using suitable techniques. Data were reported as Mean $\pm$ Standard Deviation. The student "t" test for paired data was used to compare baseline and 12 months clinical parameters.

RESULTS

Throughout the study period all patients maintained a good standard of supragingival plaque control. Descriptive statistics for the clinical parameters at the baseline and 12 months after surgery are presented in table 1 and 2.

Table: 1 Mean changes in soft tissue parameters from baseline to 12 months

PARAMETERS	BASELINE	12 MONTHS
RD	4.45 $\pm$ 1.27 mm	0.77 $\pm$ 0.80 mm
RW	3.75 $\pm$ 0.83 mm	1.75 $\pm$ 1.58 mm
CAL	5.55 $\pm$ 1.23 mm	1.77 $\pm$ 0.80 mm
KTH R	2.75 $\pm$ 1.06 mm	4.90 $\pm$ 1.55 mm
PD R	1.15 $\pm$ 0.36 mm	1.10 $\pm$ 0.44 mm
KTH D	4.95 $\pm$ 0.99 mm	4.75 $\pm$ 0.85 mm

The above table shows mean and standard deviation of recession depth (RD), recession width (RW), clinical attachment level (CAL), Keratinized tissue height of recipient teeth (KTH R), Probing depth of recipient teeth (PD R), Keratinized tissue height of donor teeth (KTH D) at preoperative and 12 months postoperative.

Table 2: Mean difference and significance of difference in parameters from baseline to 12 months

PARAMETERS	DIFFERENCE (BASELINE TO 12 MONTHS)	T VALUE	P VALUE
RD	3.47 ± 0.39 mm	17.65	<0.0001
RW	2.0 ± 0.40 mm	5.05	<0.0001
CAL	3.57 ± 0.38 mm	18.22	<0.0001
KTH R	2.15 ± 0.42 mm	6.68	<0.0001
PD R	0.05 ± 0.12 mm	0.36	>0.05
KTH D	0.2 ± 0.29 mm	1.71	>0.05

The above data indicates that recession depth reduction, increase in clinical attachment level, increase in keratinized tissue height of recipient tooth is highly significant, reduction in recession width is significant while change in probing depth of recipient tooth and keratinized tissue height of donor tooth is not significant.

Table 3: Mean % of root coverage achieved at 12 months

	RD BASELINE	AT 12 MONTHS	% ROOT COVERAGE
(MEAN ± SD)	4.45 ± 1.27 mm	0.77 ± 0.80 mm	84.0 ± 0.15 %

Table 4: Percentages of cases with complete root coverage at 12 months in relation to height of keratinized tissue included in the flap

KT FLAP	COMPLETE COVERAGE/ TOTAL NO. OF CASES
1 mm	0/3 (0 %)
2 mm	2/9 (22.22 %)
3 mm	5/7 (71.42 %)
4 mm	1/1 (100 %)

The above table indicates relation between complete root coverage and keratinized tissue included in flap.

The mean level of clinical attachment reduced from baseline (5.55 ± 1.23 mm) to 12 months (1.77 ± 0.80 mm) (Table 1). Thus, mean gain in clinical attachment level 3.57 ± 0.38 mm (12 months) (Table 2) was statistically highly significant ($P < 0.0001$).

Height of keratinized tissue at recipient or treated teeth increases from baseline (2.75 ± 1.06 mm) to

12 months (4.90 ± 1.55 mm) (Table 1). Mean gain in height of keratinized tissue at recipient teeth 2.15 ± 0.42 mm (12 months) (Table 2) was statistically highly significant ($P < 0.0001$).

Probing depth of recipient teeth decreases from baseline (1.15 ± 0.36 mm) to 12 months postoperatively (Table 1). This difference (0.05 ± 0.12 mm) (Table 2) was not statistically significant.

Height of keratinized tissue at donor tooth changes from the baseline (4.95 ± 0.99 mm) to the 12 months (4.75 ± 0.85 mm) (Table 1). This change 0.2 ± 0.29 mm (Table 2) was not statistically significant ($P > 0.05$).

Mean recession width decreases from baseline 3.75 ± 0.83 mm to 1.75 ± 1.58 mm after 12 months (Table 1). This change (i.e., 2.0 ± 0.40 mm) (Table 2) in gingival recession width was significant ($P < 0.0001$). Out of total 20 patients, in 8 patients recession width is reduced to 0.0 corresponds to complete root coverage.

Mean Recession depth decreases from baseline (4.45 ± 1.27 mm) to 3 months (0.97 ± 1.19 mm) and 12 months (0.77 ± 0.80 mm) (Table 1), corresponding to a root coverage of 3.47 ± 0.39 mm (12 months) (Table 2). In terms of mean percentage of root coverage, 84.0% ± 0.15% of the exposed root was covered with soft tissue after 12 months (Table 3).

Complete root coverage (gingival margin at the level of the CEJ) was accomplished in 8 patients out of total study sample of 20 patients (i.e., 40.0%). Amongst 20 patients, 9 patients had 2 mm height of keratinized tissue included in flap and complete root coverage been obtained in only 2 patients (i.e., 22.22 %). In 7 patients, height of keratinized tissue included in flap was 3 mm and complete root coverage was obtained in 5 patients (i.e., 77.42 %) whereas only 1 patient had 4 mm height of keratinized tissue included in flap resulting in complete root coverage (i.e., 100 %) (Table 4).

DISCUSSION

The present study was carried out to clinically evaluate the amount of soft tissue coverage achieved with laterally moved coronally advanced flap. The result of present study in terms of reduction in recession depth and percentage of root

coverage achieved after 12 months is higher than that previously reported for the lateral pedicle flap techniques³⁻¹¹. The higher results can be explained by more rigid case selection and modifications in surgical technique².

Complete root coverage (gingival margin at the level of the CEJ) was accomplished in 8 patients out of total study sample of 20 patients (i.e., 40.0%). Number of cases with complete root coverage increases with increase in keratinized tissue of flap. This finding was in accordance with Zuchelli et al. (2004)² and corresponds to increase in stability of flap due to increase in height of keratinized tissue included in flap².

The clinical cases treated in the present study were selected among those presenting the specific characteristics of the gingival tissue lateral to the recession defects: presence of a keratinized tissue width at least 6 mm greater than the width of the recession measured at the level of the CEJ and a keratinized tissue height at least 2 mm greater than the buccal PD of the adjacent tooth/teeth. Both the mesial-distal and the apical-coronal dimensions of the flap are critical for accomplishing root coverage. The stability of a flap over a denuded root depends on the mesial-distal dimension of the pedicle, (the wider the pedicle, the greater the blood supply to the marginal portion of the flap) and on the blood supply from the peripheral regions of the flap (surgical papillae) which must be wide enough (3 mm in the present study) to perform nutritional exchanges with the underlying vascular connective tissue beds (deepithelialized anatomical papillae). The apical-coronal dimension of the gingival tissue lateral to the recession is critical, not only to prevent gingival recession at the donor tooth/teeth, but also to ensure root coverage. The presence of keratinized tissue all along the mesiodistal extension of the flap improves the marginal stability of the flap itself and facilitates flap stabilization at time of suturing².

The preparation of recipient and donor site was same as that described by Zucchelli et al. (2004)² in which flap design has 3 main modifications in surgical technique with respect to those previously proposed techniques.

1. Elimination of all muscle insertions in the thickness of the flap to permit the coronal advancement of the laterally moved flap,
2. Different thickness of flap during flap elevation, and
3. Sequence of sutures.

The main modification was the elimination of all muscle insertions in the thickness of the flap to permit the coronal advancement of the laterally moved flap. The elimination of lip tensions on the flap likely compensated for the difference in the apical-coronal position between the submarginal horizontal incision and the cemento-enamel junction. Furthermore, the coronal advancement of the flap allowed the surgical papillae to cover the anatomic papillae which represented the most coronal areas for anchoring the flap and a critical source for vascular exchanges. In addition, coronal advancement of the flap beyond the cemento-enamel junction likely compensates for the post-surgical soft tissue contraction, resulting in no exposure of the root surface. Thereafter, the proposed surgical technique combined the root coverage and esthetic advantages of the coronally advanced flap¹ with the increase in gingival thickness and in the amount of keratinized tissue associated with the use of the laterally moved flap.

The different thickness during flap elevation (greater in the central area than in the more peripheral portions of the flap) represented another aspect of the proposed surgical technique. Borghetti A (1990)¹², Holbrook T (1983)¹³ reported that the stability of a flap over a denuded avascular root surface becomes more predictable by increasing the thickness of the flap. In a thicker flap the amount of vascularized connective tissue increases and the post-surgical soft tissue contraction decreases. Both these factors improve the possibility of accomplishing and maintaining root coverage. In order to further increase the thickness of the flap, full thickness elevation should have been performed, but this would have also increased the risk of gingival recession and/or bone dehiscence/fenestration at the donor site/tooth. Furthermore, the appearance of an unaesthetic scar following the healing of the exposed bone area was highly probable². The preservation of periosteum to protect the donor site was critical for the esthetic

end result. Therefore, certain amount of the lateral periosteum tissue must be preserved in situ to prevent the appearance of an unaesthetic scar following the healing of the exposed bone area at the adjacent donor site, while the remaining part is used to cover the exposed root surface (Kerner et al., 2009)¹⁴. The lower thickness of the surgical papillae, compared to that of the mid-portion of the flap, facilitated the nutritional exchanges between them and the underlying deepithelialized anatomical papillae and improved the blending in terms of color and thickness of the surgically treated area with respect to adjacent soft tissues².

Another feature of the present surgical technique was the sequence of sutures. The apical stabilization sutures in the most apical extension and along the releasing incision and the double mattress horizontal suture at the fornix were performed before the marginal sling suture. Thus the most marginal portion of the flap was stable in the desired coronal position without disrupting forces acting on it at the time of the final suture. Furthermore the double mattress suture reduced lip tension on the marginal portion of the flap during the first healing period².

The rate of successful outcomes of the treatment is comparable to that obtained by Zuchelli et al. (2004)² and higher than that previously reported for the laterally moved flap technique³⁻¹¹.

CONCLUSION

Within the of present study, it was observed that results obtained by laterally moved coronally advanced flap in terms of soft tissue coverage, reduction in width of recession, gain in clinical attachment level and keratinized tissue height, remained stable postoperatively from 6 months to 12 months period. The specific selection criteria of the donor tissue and modification in surgical technique can be considered as important aspects in achieving favorable results. Hence, laterally moved coronally advanced flap technique is highly effective and predictable in obtaining root coverage of isolated gingival recession cases.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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