

Increasing the Apico-Coronal Dimension of Attached Gingiva by using the Modified Apically Repositioned Flap Technique: A Clinical Study

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Abstract: *The MARF surgical technique consists of a single horizontal incision within keratinized tissue, elevation of a split-thickness flap, and suturing of the flap to the periosteum in an apical position. The periosteum is left exposed so that the full perimeter of the wound is surrounded by keratinized tissue. The nature of this wound healing leads to the formation of new keratinized and attached tissue in the area where periosteum is left exposed. The treatment areas consisted of a minimum of two and a maximum of four adjacent teeth with a minimum of 0.5 mm and a maximum of 2.0 mm of attached gingiva on each tooth. Treatment with MARF resulted in a significant increase in the apico-coronal dimension of the keratinized tissue and attached gingiva. Gingival recession decreased significantly in the treated areas, but the difference was of little clinical significance. Probing depths in the treated areas did not change significantly compared to baseline values.*

Keywords: gingival recession, attached gingival, keratinized gingiva, MARF.

1. Introduction

The attached gingiva is composed of keratinized epithelium, dense connective tissue, and periosteum and plays an essential role in the protection of the periodontal structures. The attached gingiva provides increased resistance of the periodontium to external injury, contributes to the stabilization of the gingival margin position, and aids in the dissipation of physiological forces that are exerted by the muscular fibers of the alveolar mucosa onto the gingival tissues.¹⁻³ It has been suggested that an adequate amount of attached gingiva is required to protect the periodontium and promote periodontal health.⁴⁻¹² However, there are situations in which the dimension of the attached gingiva is decreased (less than optimal) or non-existent. A variety of surgical techniques have been proposed to augment the zone of attached gingiva.¹³⁻²⁵ Carnio and Camargo described a variation of the modified apical repositioned flap (MARF) technique for augmenting the dimension of the attached gingiva on multiple adjacent teeth. The advantages of the MARF technique include simplicity and ease of execution because it involves the use of a single horizontal incision in the recipient site, absence of palatal donor tissue, shorter operative time, and enhanced color match between the treated and native gingival tissues.

The purpose of this case series was to conduct an objective clinical evaluation of the MARF with respect to its effectiveness in increasing the dimension of attached gingiva and to document changes in keratinized tissue, probing depth, and gingival recession associated with this modality of treatment.

2. Materials and Methods

The study was conducted in the Department of Periodontology, H.P. Government Dental College & Hospital SHIMLA (H.P.). The proposed study was carried out

on subjects having attached gingiva equal to or less than 1mm on the facial aspect of the teeth. Statistically significant subjects (23 sites), in the age group ranging from 15-45 years were treated using variation of modified apically repositioned flap technique.

Inclusion Criteria

- 1) Subjects willing to participate in study.
- 2) Subjects requiring an increase in the width of attached gingiva i.e prosthodontic reasons, orthodontic reasons, subgingival restorations, periodontal reasons.
- 3) Patients with width of attached gingiva equal to or less than 1mm on the facial aspect of the teeth.
- 4) Patients in the age group of 15-45 years of either sex.
- 5) Patients free from systemic diseases.
- 6) Miller's class I, class II and class III recession defects.

Exclusion Criteria

- 1) Non compliant subjects.
- 2) Subjects with history of previous surgical treatments done to increase the width of attached gingiva.
- 3) Current smokers.
- 4) Medically compromised subjects.
- 5) Pregnant patient.
- 6) Mobile teeth.
- 7) Deep bite.
- 8) Removable partial denture in the area to be treated.
- 9) Patients who are allergic to medicines, likely to be used for the treatment procedure.
- 10) Dermal/autoimmune diseases.
- 11) Poor oral hygiene.

Study Design

The subjects fulfilling the inclusion criteria were treated with variation of Modified apically repositioned flap technique. The procedure was explained to all the subjects prior to enrolling them for study and a written consent was taken.

Volume 8 Issue 11, November 2019

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Armamentarium

- Diagnostic instruments.
- Radiographs-IOPA, OPG.
- Periodontal probe (UNC-15).
- Schiller's potassium iodide solution.
- Bard parker knife with no-15 surgical blade.
- 5-0 black silk suture with 1/2 circle, reverse cutting, 16mm middle.
- Non eugenol periodontal dressing (Coe-pak).
- 2% xylocaine anesthetic solution with (1:100000) adrenaline.

Investigations

- Complete hemogram.
- Bleeding time, Clotting time.
- Blood sugar
- Random blood sugar.

Procedure Outline

All the subjects were subjected to a session of full mouth scaling and root planing. After completion of scaling and root planing, subjects were recalled after three weeks for pre-surgical examination. Schiller's potassium iodide solution was used to mark the mucogingival junction, Width of attached gingiva was measured by subtracting the sulcus depth from total width of gingiva (gingival margin to mucogingival junction).

3. Surgical Technique

At the time of surgical procedure, areas in which the MARF was intended to be used presented with minimal or no gingival inflammation, physiologic sulcus depth, and at least 0.5 mm of attached gingiva. Following administration of local anesthesia with 2% xylocaine containing adrenaline at a concentration of 1:100000, a horizontal beveled incision was made with a no. 15 surgical blade approximately 0.5 mm coronal to the mucogingival junction into the attached gingiva. This initial horizontal incision was performed at an angle of 30- 45 degrees, formed by the blade and the portion of the gingival surface coronal to the blade. Therefore, the blade makes contact with periosteum at a point slightly apical to the alveolar crest. In the mesiodistal direction, this initial horizontal incision should be parallel to the mucogingival junction so that approximately 0.5 mm of gingiva remains along the coronal portion of the whole flap. The gingiva present coronal to the initial incision remains intact around the teeth. The mesiodistal extension of the initial horizontal incision was determined by the number of teeth involved in the procedure and should be extended by at least one half tooth mesially and distally of the areas in which gingival augmentation was desired. This extension will allow for apical repositioning of the flap without the use of vertical releasing incisions. A split thickness flap was elevated with a no. 15 blade, and the dissection was extended in the apical direction as far as deemed necessary. The further apical the dissection was carried out, the wider the net gain in attached gingival dimensions. A dissection 5 to 6 mm in an apical direction was usually sufficient. The flap was then moved apically and secured to the periosteum with interrupted sutures using 5-0 black silk suture. With a moist 2x2 cm gauze, gentle digital pressure was applied to

the surgical area for 3 to 5 minutes to maintain the flap in close contact with the underlying periosteum. At the end of surgical procedure, inspection of the exposed periosteal area should reveal a thin, homogenous layer of periosteum with no movable tissue (neither elastic nor muscular fibers). A tin foil was placed over the sutures and non- eugenol periodontal dressing was applied during the first postoperative week. Postoperative care consists of 0.12% chlorhexidine rinses three times daily for 4 weeks, cap. Amoxicillin 500 mg three times daily for 5 days and tab. Ibuprofen 400 mg three times daily for 3 days. Same regimen was extended as per the patient need. The sutures and periodontal dressing were removed after 1 week postoperatively. Mechanical oral hygiene of the surgical area in the form of brushing and flossing was not initiated until the beginning of the fifth postoperative week. At the 6 to 8 weeks postoperatively, an increase in the apicocoronal dimension of the attached gingiva, corresponding to the area where periosteum was left exposed, was typically observed. Fig. 1a-1g.

Postoperative care consists of cap. Amoxicillin 500mg three times daily for 5 days, tab. Ibuprofen 400 mg every 8 hours for 3 days and the same regimen may be extended as per the patient need. 0.12% chlorhexidine rinses three times daily for 4 weeks. Sutures were removed after one week postoperatively.

Data Collection

Probing pocket depth, width of attached gingiva, width of keratinized gingiva was recorded at baseline i.e immediately prior to surgical procedure and finally after 12 weeks. Results were compared in terms of:

Objective criteria

- 1) Initial v/s final probing pocket depth.
- 2) Increase in the width of attached gingiva.
- 3) Increase in the width of keratinized gingiva.

In addition to above mentioned objective criteria subjects were asked about their experience with the techniques using visual analogue scale (VAS).

Subjective criteria

- 1) Intra operative discomfort.
- 2) Post operative pain and swelling.
- 3) Post operative complications.
- 4) Whether patient required analgesia after 3 days or not, if yes, for how many days.

Statistical Analysis

Descriptive statistics were expressed as means \pm SD and frequency distributions. The paired t- test was used for comparisons of various parameters between 0 week (Base line) and 12 weeks.

4. Results

12 subjects (10 females and 2males), aged 34.7 ± 8.2 years, age range 24-45 years were treated with variation of modified apically repositioned flap technique. The mean probing pocket depth at base line (0 week) was 1.26 ± 0.44 mm and at 12 weeks the probing pocket depth was 1.04 ± 0.20 mm. Change in probing pocket depth over a time period

of 12 weeks was 0.21 ± 0.42 mm. The change in probing pocket depth was statistically significant, ($p=0.02$) and $df=22$.

The mean width of attached gingiva at base line (0 week) was 1.22 ± 0.42 mm and at 12 weeks the width of attached gingiva was 2.91 ± 0.66 mm. The width of attached gingiva increased over 12 weeks by 1.69 ± 0.63 mm. The change in width of attached gingiva was statistically significant, $p < 0.001$, and $df=22$.

The mean width of keratinized gingiva at base line (0 week) was 2.47 ± 0.51 mm and at 12 weeks the width of keratinized gingiva was 3.95 ± 0.63 mm. The width of keratinized gingiva increased by 1.69 ± 0.63 mm. The change in width of keratinized gingiva was statistically significant, $p < 0.001$ and $df = 22$.

8.3% (1 out of 12) subjects showed intraoperative discomfort and the postoperative mean VAS pain score was 3.08 ± 1.97 . 16.6% (2 out of 12) subjects reported swelling at operated site. No postoperative hemorrhage, trismus, wound infections or any other complications were reported. 33.3% (4 out of 12) subjects took analgesics for three days as prescribed. 41.6% (5 out of 12) subjects did not follow the instructions to take analgesics for 3 days and stopped taking the analgesics on day 1 (3 subjects) and 2 subjects on day 2. 8.3% (1 out of 12) subjects required analgesics for 4 days and 16.6% (2 out of 12) required analgesics for 5 days.

5. Discussion

Treatment of mucogingival deficiencies with MARF, as described in this case series, constituted an efficient and predictable modality of therapy to increase the apico-coronal dimension of attached gingiva with minimal morbidity, fast healing, and good esthetics. Clinical postoperative inspection of the surgical areas consistently revealed the presence of granulation tissue in the entire surgical site at the end of the first week. At postoperative weeks 12 treated areas were covered with tissue that had a clinical appearance very similar to the adjacent native gingival tissue. From an esthetic standpoint, the newly formed tissue was clinically indistinguishable from the adjacent gingival tissue at 12 weeks postoperatively.

The results achieved with MARF have several advantages compared to other surgical techniques used to increase the zone of attached gingiva: no further attachment loss,¹⁹ absence of a palatal donor area,¹⁵ ease of execution, and predictable esthetic results.²⁷ These results were obtained with minimal postoperative discomfort and without increasing probing depth and marginal tissue recession.

The average increases in the apico-coronal dimension of the keratinized tissue and the attached gingiva were 1.69 ± 0.63 mm, which were of clinical significance. According to several reports, 2.0 mm of attached gingiva is sufficient for the maintenance of periodontal health,^{5,7,12,28} even in cases in which subgingival restoration margins are placed.^{4,6,8,9} MARF uses a single horizontal incision, and there is no need for vertical releasing incisions to achieve flap mobilization. The mesio-distal extension of the initial horizontal incision,

by virtue of being extended at least one-half tooth in each direction, provides the flap with adequate mobility for apical repositioning. The bevel created in the horizontal incision, by having its end at a point slightly apical to the alveolar crest, allows that portion of the gingiva to remain undisturbed in its original position and protects the bone crest from being resorbed. The flap, which presents with keratinized tissue on its coronal border, is then positioned apically, resulting in the intentional exposure of the periosteal area where gingival augmentation is desired. In this manner, the whole periphery of the surgical area is surrounded by keratinized tissue, which serves as a source of cells with a keratinized phenotype.

According to Karring et al.,²⁹⁻³¹ the main determining factor of the nature of the new tissues that develop over the exposed periosteum rests with the origin of the granulation cells that migrate over the wound. These cells migrate from the periosteal connective tissue, adjacent gingival and alveolar mucosa, periodontal ligament (PDL), and bone marrow spaces. The surgical wound created by MARF is surrounded completely by keratinized tissue. This prevents non-keratinized epithelial cells originating from the oral mucosa from proliferating onto the surgical area. Therefore, the connective tissue and epithelial cells surrounding the wound migrate from the margins to cover the exposed periosteum. In the MARF technique, PDL cells probably are not involved in the wound-healing process; the beveled incision is designed to leave a band of connective tissue that prevents the bony crest from being reabsorbed and consequently protects the PDL.^{23,25} A major limitation of the MARF technique is the need for ≥ 0.5 mm of attached gingiva to be present presurgically. This is necessary to allow for the full perimeter of the wound to be surrounded by keratinized tissue, and that is important in the originating process of the granulation tissue during healing. The presence of bone dehiscences is another factor that contraindicates the MARF surgical technique.

6. Conclusion

The predictable increase in the apico-coronal gingival dimension with MARF offers considerable advantages over other mucogingival surgery techniques, such as low morbidity because of the absence of palatal donor tissue and predictable color match. Furthermore, the steps involved in the MARF execution are simple, and the surgical procedure can be conducted expeditiously with limited chair time for the patient and the operator.

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Figures



Figure 1(a): Clinical view showing Deficient attached Gingiva



Figure 1(b): Schiller's KI solution used to mark MGL



Figure 1(c): Horizontal incision made 0.5 mm coronal to the MGL raising partial thickness flap.



Figure 1(d): Flap sutured apically, leaving the Periosteum exposed.

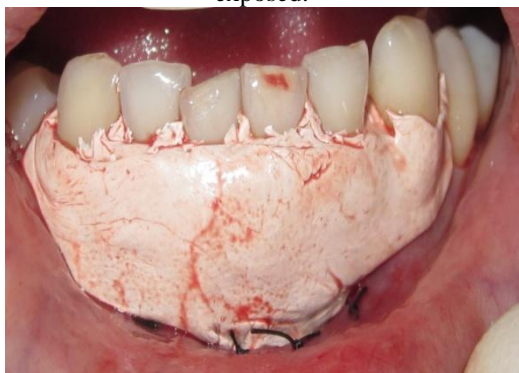


Figure 1(e): Surgical wound covered with coe-pak.



Figure 1(f): Surgical wound after 1 week post-operatively.



Figure 1(g): Clinical view of surgical wound after 12 weeks post-operatively, showing marked increase in the width of attached gingiva.