CASE REPORT

Modified Apically Repositioned Flap: A Novel Technique for Increasing the Width of Attached Gingiva: A Case Series

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ABSTRACT

This case series describes a modified technique for increasing the width of the attached gingiva (AG). The described technique is a variation of the apically repositioned flap technique previously proposed by Freidman in 1962. The modified apically repositioned flap (MARF) technique uses a single horizontal incision within the keratinized tissue (KT), elevating a split-thickness flap, and suturing of the flap to the periosteum in an apical position. Periosteum is left exposed in the area between the initial horizontal incision and the coronal margin of the flap. The full perimeter of the exposed periosteal area is completely surrounded by KT. Therefore, keratinized epithelial cells migrate over the periosteum during the wound healing, resulting in the formation of keratinized attached tissue in the area of the previously exposed periosteum. Four patients were selected and analyzed for the efficacy of MARF. Treatment area consisted of minimum two and maximum five adjacent teeth with minimum 0.5 mm of AG on each tooth. Treatment with MARF resulted in a significantly increased in AG in all four cases. Increase in the AG ranged from 1 to 2.5 mm. The increase in KT ranged from 1 to 1.5 mm. There was no significant change in probing pocket depth. The advantages of this technique include: Minimal surgical trauma; it does not require a second surgical site; it is less time-consuming; and it results in a perfect gingival color match.

Key Words: Gingiva, gingival recession, periodontal attachment loss.

Introduction

The width of the attached gingiva (AG) is an important clinical parameter. It is the distance between the mucogingival junction (MGJ) and the projection on the external surface of the bottom of the gingival sulcus or the periodontal pocket.[1]

The presence of an adequate zone of AG was considered critical for the maintenance of marginal tissue health by many distinguished researchers (Friedman and Levine, 1964; Nabers, 1966; Lang and Löe, 1972; Bernimoulin and Mühlemann, 1973; Ochsenbein and Maynard, 1974; Hall, 1981; Matter 1982).[2-8] However, many authors refuted this claim and concluded that the gingival health can be maintained independent of its dimensions (Lindhe and Nyman, 1980; Wennström and Lindhe, 1982; Kennedy *et al.*, 1985; Wennström, 1987; Freedman, 1992).[9-13] However, it is well-known that an inadequate zone of the gingiva is insufficient to protect the periodontium from injury caused by frictional forces encountered during mastication.[3] It cannot dissipate the pull on the gingival margin created by the muscles of the adjacent alveolar mucosa (Friedman, 1999; Ochsenbein, 1960).[14,15] An "inadequate" zone of the gingiva would (1) facilitate subgingival plaque formation because of improper pocket closure resulting from the movability of the marginal tissue and (2) cause attachment loss and soft tissue recession because of less tissue resistance to apical spread of plaque-associated gingival lesions (Stern 1981; Ruben 1979).[16,17] It was also considered that an inadequate AG with a shallow vestibular fornix might favor the accumulation of food particles during mastication, and impede proper oral hygiene measures (Gottsegen, 1954; Corn, 1962; Rosenberg *et al.*, 1981; Carranza and Carraro, 1970).[18-21]

A variety of surgical techniques have been introduced to increase the width of AG. The earliest documented surgical techniques were:[22] Push-back technique by Robinson and Fox 1953, vestibular extension technique designed and independently

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by Bohannan in 1962, the apically repositioned flap (APF) by Freidman in 1962, and free autogenous gingival grafts by King and Pennel 1964.[22]

The apically positioned flap was first designed and described by Friedman in 1962. The flap was elevated by an internal bevel incision and two vertical incisions. Vertical incisions were used to outline the surgical site and made at mesial and distal line angles of terminal teeth. Incisions were extended 3-4 mm into the alveolar mucosa to allow proper flap repositioning.[13] Flap was subsequently displaced in apical position. Similar to the other techniques, the APF flap left 3-5 mm of alveolar bone denuded in coronal part, which was associated with a higher risk of bone resorption[4] and regional accelerated phenomenon.[13]

In order to overcome the drawbacks of the APF, a modification was given by Carnio and Miller in 1999.[23] The modified apically repositioned flap (MARF) involves a single horizontal incision. It is easy to execute, simple and requires less chair time for the patient and the operator. The horizontal incision is made parallel to the MGJ so that 0.5 mm gingiva remained coronal to the flap. Its extension allows the repositioning of the flap apically without the use of vertical releasing incisions. Using the MARF technique to increase the donor area has an advantage over FGG, as it eliminates second surgical site.[23]

Case Report

This case series outlines the use of the MARF technique and evaluates its efficacy for increasing the width of AG. Four patients in the age group 20-50 years were selected from the Outpatient section of the Department of Periodontics and Oral Implantology at Dr. D. Y Patil Dental College and Hospital, Pune, India. This study was approved by the Ethics and Scientific Committee of the Institute. Written informed consent was obtained from all four patients. The inclusion criterion for patient selection was an inadequate zone of AG (<2.0 mm). Subjects with dehiscence and fenestration, active infection, having any systemic history, bleeding tendency, or any other systemic condition, which might influence the course of periodontal therapy, use of tobacco in any form, history of use of antibiotics, and analgesics in the previous 3 months were excluded. All patients underwent non-surgical periodontal therapy and received oral hygiene instructions. The clinical parameters evaluated were width of AG, width of keratinized tissue (KT), and the probing depth (PD).

When measuring apico-coronal height, iodine solution was applied to the gingiva to visualize the MGJ**.** The width of AG was determined by subtracting PD from apico-coronal length of the KT. The width of KT was measured from gingival margin to MGJ. PD was measured using UNC 15 periodontal probe from gingival margin to base of the sulcus.

Surgical technique

Local anesthesia using 2% lignocaine hydrochloride with 1:2,00,000 epinephrine was administered. A horizontal incision in the AG was made with no. 15 Bard-Parker blade, 0.5 mm coronal to MGJ. Horizontal incision was made parallel to MGJ. This incision was beveled with the blade making contact with the periosteum at a point apical to alveolar crest. The mesiodistal extension of horizontal incision was decided by the number of teeth involved in the surgical procedure. Incision length was extended to one and half of the tooth in either direction. This allowed the flap to move apically at a desired level of augmentation. A split thickness flap was elevated. The dissection was extended in apical direction at a desired level. The flap was moved apically and sutured to the periosteum using 4-0 resorbable suture. Interrupted periosteal sutures were given to secure the flap apically. Post-operative instructions given were: Use of 0.2% chlorhexidine mouthwash for 2 weeks and not to brush in the surgical area during the 1st week. Three weeks after the surgical procedure, all the sites appeared to have healed adequately with no post-operative complications. The clinical measurements were recorded 3 months after surgery (Table 1). In the first two cases, width of AG and KT and increased significantly (1-1.5 mm); however, no difference was observed for PD at baseline and after 3 months. In the third case, the dimensions of AG increased significantly (1.8 mm) compared to baseline, but minimal difference was seen in KT, and PD. In the fourth case, AG increased by 2 mm and KT by 1 mm no significant difference in PD. Statistical significant (AG) was 0.0067.

Results

Pre- and post-operative clinical measurements are reported in Table 1. Treatment with MARF resulted in a significant increase of AG. Keratinized gingiva also increased in three of the four cases. PD did not change in any case.

Discussion

The width of AG is generally greater in incisors compared to posterior segments and is least in the premolars.[1] It is composed of keratinized epithelium and dense connective tissue.[24] AG is bound

Table 1: Parameters at baseline and at 6 months.

Cases	Parameters					
	Baseline			3 months		
	AG	KT	PD	AG	KT	PD
1	1.5	2.5	1	2.8	3.5	1
2	2	3	1	3.5	4.5	1
3	1.5	2.5	1	3.3	3.3	1
4	1	2	1	3	3	1

AG: Attached gingiva, KT: Keratinized tissue, PD: Probing depth

to underlying periosteum and protects the periodontium. It helps to stabilize the gingival margin position. It also acts as a barrier against physical trauma by tooth brushing facilitating plaque control. Deficient AG with poor plaque control may lead to gingival recession.[22] Data suggests that 2 mm of the gingiva is an adequate width for maintaining gingival health.[10] Lang and Loe in 1972 reported that areas with 1 mm or <1 mm AG often presented with clinical signs of inflammation.[4] Maynard and Wilson in 1979 stated that 5 mm KG with 3 mm AG is necessary for gingival health when sub-gingival restorations are planned.[25] Friedman in 1962 said that an adequate amount of the gingiva is any dimension of the gingiva that is compatible with gingival health or that prevents gingival margin during movements of the alveolar mucosa. According to Trombelli[26] gingival augmentation should be taken into account whenever a change in mucogingival morphology will facilitate plaque control.[26] A minimal amount of AG on the facial and lingual surface should be indicated as a pure mucogingival problem in which gingival augmentation is indicated.[27] Hall mentioned that areas with <2 mm of AG should be checked for active recession.[27] Clinically, it has been suggested that adequate amount of AG is necessary to protect periodontium and to avoid the consequences due to decrease a width of AG.[28] This case series employs the use of the MARF technique to treat inadequate AG (Figure 1).

Modified apically repositioned flap shows several advantages over the routinely applied techniques for increasing the width of AG.[2,23,24] The technique results in no further attachment loss, is easy to execute, gives predictable results and causes less discomfort to the patient due to lack of second donor site. From the esthetic point of view, the advantage of MARF is that it prevents gingival recession that is seen in APF.[24] The bevel created in the horizontal incision by having its end at the point just apical to alveolar crest protects the bone crest from being resorbed. After the flap has been positioned apically and sutured, periosteal area is left exposed. According to Karring *et al.*[28] the main factor determining the nature of the epithelial surface that will develop over the exposed periosteum is the origin of the epithelial cell that will migrate over the wound and is eventually surrounded by the KT.[28] As the epithelial cells migrating from margins of the wound to cover the exposed connective tissue are keratinized in nature, which results in the formation and maturation of KT. This will prevent the proliferation of non-keratinized cells originating from the oral mucosa to the surgical area. Hence, it gives a predictable gingival color match with surrounding tissue.[28] The results of this study showed that MARF is an effective and efficient technique to increase the keratinized and attached tissue width. A major limitation of the MARF technique is a need for ≥0.5 mm AG to be present pre-surgically. This is necessary to allow for the full perimeter of the wound to be surrounded by KT and is important in origin of the granulation tissue during healing.[28] The presence of bone dehiscence is another factor contraindicated in MARF technique. If a distance of more than 0.2 mm is present at the bottom of the pocket and bony crest, root dehiscence is likely to occur when a flap is positioned apically, which enhances the probability of the gingival recession (Figure 2).

Conclusion

Modified apically repositioned flap is an effective and efficient procedure to increase the keratinized and attached tissue width. Its advantages include: Simple and easy technique; minimal surgical trauma/less discomfort; it is less time-consuming;

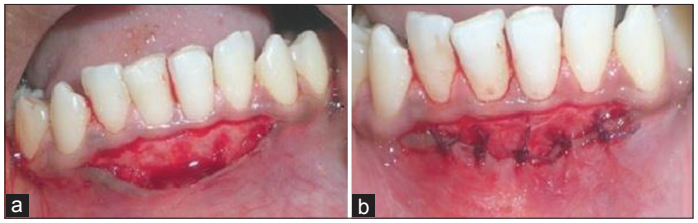

Figure 1: Horizontal incision, reflection, and apical displacement of flap in modified apically repositioned flap technique.

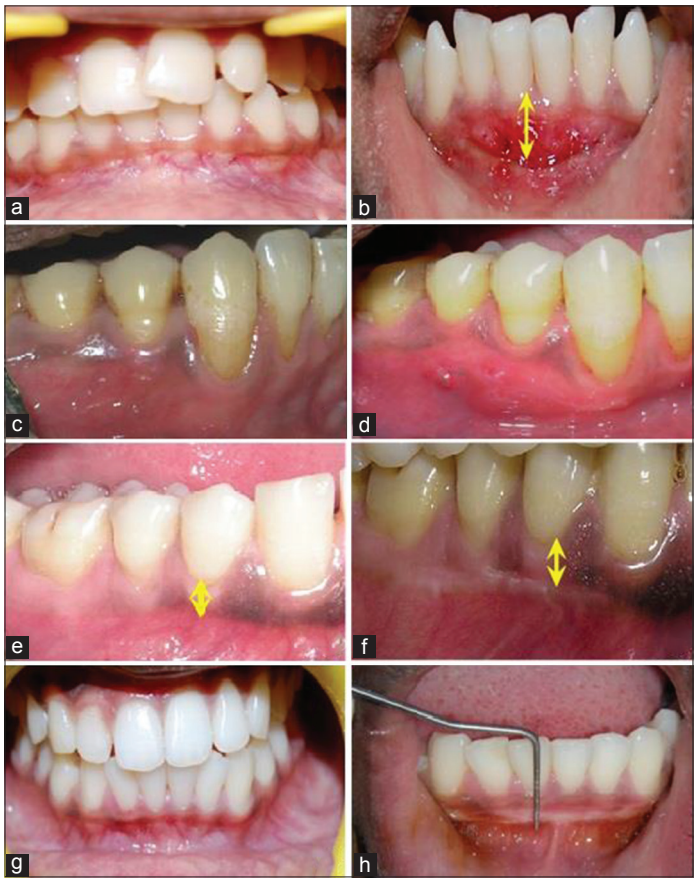

Figure 2: Pre- and post-operative of all four cases: Case 1: (a) Pre-operative, (b) post-operative. Case 2: (c) Pre-operative, (d) post-operative. Case 3: (e) Pre-operative, (f) post-operative. Case 4: (g) Pre-operative, (h) post-operative.

perfect aesthetics; predictable results; no post-operative complications like recession/alveolar bone loss; it and does not require a second surgical site.

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