A NEW APPROACH FOR INCREASING THE WIDTH OF ATTACHED GINGIVA BY MODIFIED APICALLY REPOSITIONED FLAP

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20 subjects were enrolled in this study.10 were treated with apically repositioned flap technique (control group) and 10 with modified apically repositioned flap technique (experimental group). The width of attached gingiva, keratinized gingiva, probing pocket depth and gingival recession is measured at day 0 and at 3 months postoperatively on the mid-buccal aspect of the treated teeth. Statistical analysis was performed using't' test.

Significant increase in width of attached and keratinized gingiva were observed in both the groups ($p<0.05$). The experimental group has shown slight reduction in gingival recession as compared to control group in which gingival recession has increased. No significant change in probing pocket depth was found in experimental group. There is slight reduction in probing pocket depth in control group. The experimental and control group is equally effective in increasing the width of attached gingiva. The advantage of modified apically repositioned flap technique is in terms of esthetics as it prevents gingival recession which is commonly seen with apically repositioned flap technique.

Key words: Modified, attached, recession, gingiva.

The attached gingiva is made of keratinized epithelium and dense bundle of collagen fibres that is firmly adherent to the underlying bone and thus protects the periodontium. The function of attached gingiva is accomplished by zone of varying width. It serves as an effective barrier against physical trauma caused by toothbrushing and also facilitates plaque control[1].

The areas that are deficient in attached gingiva may show progressive gingival recession and establishing an adequate zone of attached gingiva in such areas will provide stability to the gingival margin position. A functionally adequate amount of attached gingiva is not a matter of mm, but rather a sufficient amount to dissipate the pull of the musculature transmitted through the frenum or the alveolar mucosa that may retract the marginal gingiva or interproximal papilla[2]. Moreover, an adequate amount of attached gingiva around submarginal restoration and implants is required for maintenance of gingival health. Also, the presence of attached gingiva is an important consideration when teeth are being moved orthodontically out of alveolar bone[3].

Various surgical techniques have been used to increase the areas of attached gingiva. The first surgical technique to increase the area of attached gingiva was introduced by Nabers (1954)[4] using an apically repositioned flap procedure. This technique increased the width of attached gingiva by displacing marginal gingival tissue apically and leaving a variable amount of alveolar bone crest exposed, depending on the need of attached gingiva. Apically repositioned flap procedure to increase attached gingiva was used for many years but the limitations of this technique[5] has led the clinicians to search for newer techniques in order to achieve better and more predictable results.

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Recently Carino and Miller[6] have described a modification in the apically repositioned flap technique to increase the zone of attached gingiva around a single tooth. The modified apically repositioned flap differed from the original apically repositioned flap procedure by maintaining a part of the existing keratinized gingiva in contact with the tooth as a gingival collar and only a narrow band of keratinized gingiva was moved apically.

The purpose of this study is to observe the effectiveness of modified apically repositioned flap technique in comparison to apically repositioned flap technique in increasing the width of attached gingiva.

MATERIALS AND METHODS

A total of 20 systemically healthy subjects were enrolled in this study. 10 patients were treated with modified apical repositioned flap (MARF) technique. These patients were considered as experimental group. 10 patients were treated with apically repositioned flap (ARF) technique. These patients were considered as control group. All the patients of both the groups were informed about treatment options and the surgical procedure was explained.

Inclusion criteria included presence of atleast 1.5mm of keratinized gingival on facial aspect of treatment area as measured in the apico-coronal

Table 1

Pre- and postoperative clinical measurements of different parameters:

Width of attached gingiva (WAG), width of keratinized gingiva (WKG), probing pocket depth (PPD) and gingival recession (GR) for ARF (control) group.

Patients		WKG (mm)	WAG (mm)	PPD (mm)	GR (mm)
1	At day 0	2.5	1.0	1.5	0.0
	3 months	3.5	2.5	1.0	1.5
2	At day 0	2.0	1.0	1.0	2.0
	3 months	3.0	2.5	0.5	3.5
3	At day 0	2.0	1.0	1.0	0.5
	3 months	5.0	4.0	1.0	1.0
4	At day 0	2.5	1.0	1.5	3.0
	3 months	3.0	2.5	0.5	4.0
5	At day 0	2.5	1.0	1.5	0.0
	3 months	3.5	3.0	0.5	0.5
6	At day 0	2.0	1.0	1.0	3.0
	3 months	3.0	2.5	0.5	3.5
7	At day 0	1.5	1.0	0.5	0.0
	3 months	2.0	1.5	0.5	1.0
8	At day 0	2.5	1.5	1.0	0.0
	3 months	3.0	2.5	0.5	1.0
9	At day 0	1.5	1.0	0.5	0.0
	3 months	2.5	2.0	0.5	1.0
10	At day 0	2.5	1.0	1.5	0.0
	3 months	3.0	2.5	0.5	0.5

direction, sufficient thickness of gingiva to elevate split thickness flap and absence of any bony dehiscence.

The clinical parameters namely width of keratinized gingiva, width of attached gingiva, probing pocket depth and gingival recession were measured preoperatively at day 0 and postoperatively at 90 days on the mid-buccal aspect of the treated teeth with a calibrated UNC-15 probe by keeping it parallel to long axis of the tooth.

When measuring the apico-coronal dimension of the keratinized tissue, a Schiller's Iodine-potassium iodide solution was applied to the gingiva to visualize the mucogingival junction (the epithelium of the alveolar mucosa yielded an iodine-positive reaction while the keratinized gingiva was iodine-negative) and the width of keratinized gingiva was measured. The width of attached gingiva was determined by subtracting the probing depth from the width of keratinized gingiva. Marginal tissue recession was measured as the distance between cemento-enamel junction and the gingival margin.

All the patients had undergone complete removal of plaque and calculus, correction of defective restorations, treatment of carious lesions and institution of a comprehensive daily plaque control regimen one month prior to surgical procedure. Surgical procedures of either modified apically reposi-

Table-2

Pre and postoperative clinical measurements of different parameters:

Width of attached gingiva (WAG), width of keratinized gingiva (WKG), probing pocket depth (PPD) and gingival recession (GR) for ARF (control) group.

Patients		WKG (mm)	WAG (mm)	PPD (mm)	GR (mm)
1	At day 0	1.5	1.0	0.5	6.0
	3 months	3.0	2.5	0.5	6.0
2	At day 0	1.8	0.8	1.0	4.0
	3 months	3.0	2.5	0.5	3.0
3	At day 0	2.0	1.0	1.0	1.5
	3 months	3.5	3.0	0.5	0.5
4	At day 0	1.5	1.0	0.5	1.5
	3 months	3.0	2.5	0.5	1.5
5	At day 0	2.5	1.5	1.0	1.5
	3 months	6.0	5.0	1.0	0.5
6	At day 0	1.0	0.5	0.5	2.0
	3 months	3.0	2.5	0.5	1.5
7	At day 0	1.5	1.0	0.5	3.0
	3 months	3.0	2.5	0.5	2.5
8	At day 0	1.5	0.5	1.0	3.0
	3 months	3.0	2.0	1.0	2.5
9	At day 0	2.0	1.0	1.0	0.5
	3 months	5.0	4.5	0.5	0.0
10	At day 0	1.5	0.5	1.0	3.0
	3 months	3.5	2.0	1.5	3.0

tioned flap as an experimental group or apically repositioned flap as a control group was done.

Following local anesthesia with 2% lignocaine containing 1:80,000 adrenaline, the control sites underwent an apically repositioned flap procedure (fig-2). An internal beveled incision was made in the marginal gingiva to remove pocket epithelium and preserving as much amount of keratinized gingiva as possible using 11 no. surgical blade on the buccal aspect of the involved tooth. This incision was horizontally extended mesial and distal to tooth. Bilateral vertical incisions were made mesial and distal to the selected teeth apically beyond mucogingival junction. Sharp dissection in apicocoronal direction allowed vertical incisions to join a horizontal incision splitting the marginal tissue, leaving periosteum and connective tissues attached to the tooth and alveolar bone. The split thickness flap reflected was apically displaced to the desired level and sutured to the periosteum with 4.0 silk suture. Pressure was applied against the flap for 2-3 minutes to secure good adaptation. All operated sites were covered with protective foil and dressed with COE periodontal pack.

The experimental sites underwent a modified apically repositioned flap technique (fig-1). A horizontal beveled incision was made in the attached portion of the keratinized gingiva slightly apical to the alveolar crest with 11no. surgical blade. The mesial and distal extensions of the initial horizontal incision were determined by the size of the tooth and the gingival contour.

Two vertical incisions were placed on the mesial and distal ends connecting the horizontal incision. These incisions extended beyond the mucogingival junction. A split thickness flap was elevated, moved apically and sutured to the periosteum by silk 4.0 suture at the desired level. Pressure was applied against the flap for 2-3 minutes to secure a good adaptation. The tissue coronal to the horizontal incision was retained as a marginal collar. All operated sites were covered with protective foil and dressed with COE periodontal pack.

Postoperative care consisted of 0.12% chlorhexidene rinses for 4 weeks.

Amoxicillin was prescribed in antimicrobial dosage (500 mg three times a day) for 5 days and Ibuprofen 400- 600mg one tablet every 8 hours for 3 days daily. At 1 week postoperatively, the periodontal dressing and sutures were removed and the surgical area was flushed with povidine-iodine antimicrobial solution. Brushing and flossing was not initiated until 3rd postoperative week.

Statistical analysis was performed using't' test. Pre- and postoperative measurements of each parameter were averaged (mean±SD), and all tests were performed at the 5% significance level. P values d"0.05 were regarded as statistically significant.

RESULTS

It has been observed (table 1) that treatment with ARF technique has resulted in statistically significant increase in width of attached gingiva and keratinized gingiva ($p<0.05$). The attached gingiva has shown significant increase in width of attached gingiva from a mean of 1.15mm (range 1.0 to 1.5mm) to 2.55mm(range 1.5 to 4.0mm) resulting a mean increase in 1.4mm. Width of keratinized gingiva has also increased from a mean of 2.25mm to 3.15mm and is clinically significant ($p<0.001$). The ARF group showed 0.5mm reduction in probing depth, which is statistically significant ($p<0.01$) and has also resulted in an increase in gingival recession postoperatively. The gingival recession has changed from a mean of 0.85mm preoperatively to mean of 1.75mm postoperatively resulting in a mean increase in 0.90mm.

Treatment with MARF resulted (table-2) in statistically significant increase in width of attached and keratinized gingiva ($p<0.05$). The width of attached gingiva increased from a width of 0.98mm(range 0.5 to 1.5mm) to 3.05mm(range 2.0 to 5.0mm) resulting in a mean increase in 1.97mm. No statistically significant difference in probing depth was detected pre- and postoperatively ($p=0.35$). Gingival recessions has shown a statisti-

Fig. 1 a, b, c- Modified apically repositioned flap.

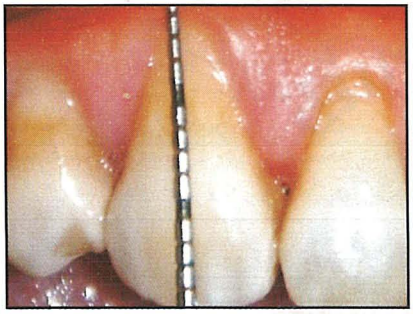


Fig-1a (Pre-operative)

Flg-1a shows preoperaulve view of modified apically repositioned flap technique. Iodine solution was applied to visualize band of keratinized tissue.



Fig-1b (Intra-operative)

Flg-1b shows Intraoperaulve view of modified apically repositioned flap technique. A horizontal beveled incision was made in the attached portion of keratinized tissue and a split thickness flap was elevated and sutured apically leaving collar of gingiva around tooth.

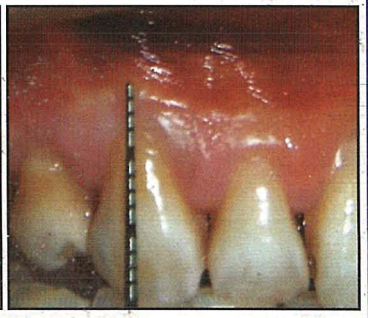


Fig-1c (Post-operative).

Flg-1c shows postoperaulve view of modified apically repositioned flap technique. Treated area shows increase in width of keratinized and attached gingiva after 3 months.

Fig.-2 a, b, c Apically repositioned flap.

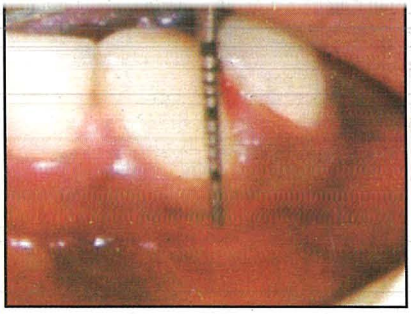


Fig-2a Pre-operative

Fig-2a shows preoperative view of apically repositioned flap technique.

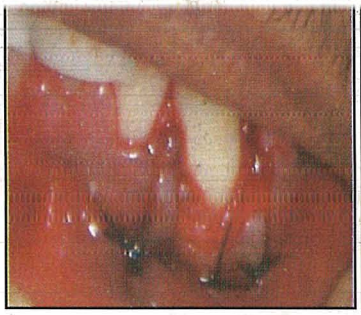


Fig-2b Intra-operative

Fig-2b shows intraoperative view of apically repositioned flap technique. The split thickness flap reflected from marginal gingiva and sutured apically.

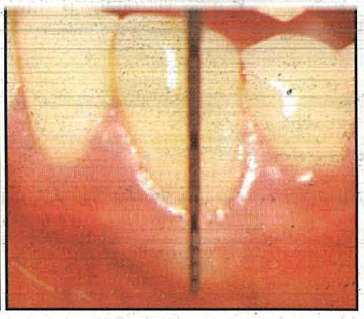
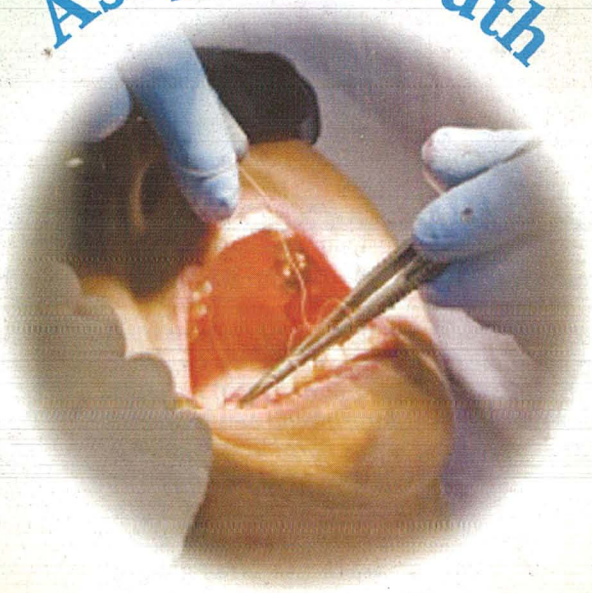


Fig-2c Post-operative.

Fig-2c shows postoperative view of apically repositioned flap technique. Treated area shows increase in width of keratinized and attached gingiva after 3 months.

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cal significant reduction ($p<0.001$) from a mean of 2.55mm pre- to 2.15mm postoperatively.

DISCUSSION

Although apically repositioned flap as a control group has shown a significant increase in width of attached gingiva postoperatively, it also has resulted in gingival recession due to the resorption of thin marginal alveolar crest. This is in accordance with the previous study done by Wood *et al* (1972)[7]. A partial thickness flap from marginal gingiva was reflected and sutured apically exposing variable band of crestal bone covered with periosteum and connective tissue. The exposed periosteal bed regenerated as attached gingiva during healing process. It is important that the edge of the flap be made up of the gingiva rather than alveolar mucosa, because the gingiva on the flap edge accounts for the pattern of healing. The relative thinness of the gingiva and the alveolar mucosa in certain areas, however, made the partial thickness flap procedure difficult. The flap was reflected with sufficient connective tissue to maintain the integrity of epithelium. In few cases, the connective tissue that remained over the radicular alveolar bone was thin to afford proper protection to the bone resulting in marginal bone resorption[8].

Modified apically repositioned flap procedure has resulted in significant increase in width of attached gingiva with minimal morbidity, fast healing and no gingival recession. These findings are comparable to the previous study made by Carnio and Miller (1999). The technique for MARF group differs from the ARF group in elevation of the split thickness flap. Split thickness flap in MARF technique was elevated leaving a gingival collar intact to the tooth surface. The bevel created in the horizontal incision of MARF, was intentionally made slightly apical to the alveolar crest within the attached portion of gingiva, which allowed the coronal portion of gingiva to remain undisturbed in its original position and protected the crestal bone from being resorbed, thus avoiding gingival recession, which was commonly seen in ARF group.

According to karring and coworkers[9] the main factor determining the nature of epithelial surface that will developed over the exposed periosteum is the origin of epithelial cells that will migrate over the wound. The epithelial cells migrating from the wound to cover the exposed connective tissue were keratinized in nature, which in turn resulted in the formation and maturation of keratinized tissue at the surgical sites.

The result achieved with MARF has shown several advantages compared to other surgical techniques used to increase the zone of attached gingiva. It does not require palatal donor tissue, which is associated with high morbidity and possibility of postoperative bleeding. The colour match generally obtained with the MARF technique consistently blends well with the adjacent gingiva. A potential problem encountered during treatment with MARF is the presence of bony dehiscence in areas of thin peridontium. However, presurgical detection of the crestal bone through sulcus probing will prevent this occurrence.

This study has shown a greater mean increase of keratinized tissue in MARF group than ARF group which may be due to the lack of standardization of the amount of periosteum left exposed at surgical site. It can be concluded that both test and control group is capable of increasing keratinized and attached gingiva of variable amount depending on the level of flap being apically repositioned and amount of periosteal bed left exposed.

Gingival recession has shown slight reduction postoperatively in MARF group. A decrease in gingival recession is likely the results of creeping attachment that never exceeded 0.5mm. The ARF group however has shown an increase in gingival recession postoperatively. This may be attributed to radicular alveolar bone loss.

CONCLUSION

It is concluded that both MARF and ARF technique are effective in producing a functionally adequate width of keratinized and attached gingiva. The results achieved with MARF were more pleasing in

terms of esthetics as it prevents gingival recession which commonly was seen in ARF technique. There were no statistically significant differences between the treatments in probing depths.

Modified apically repositioned flap procedure as described in this clinical study may be considered as an efficient and predictable method of treatment for increasing the width of attached gingiva with minimal morbidity, fast healing, and good esthetics.

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