

Vertical Strip Gingival Graft: A New Technique for Gingival Augmentation A pilot study

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Statement of Problem: Although no minimum width of attached gingiva has been established as a standard for gingival health; gingival augmentation has been carried out because of many reasons. There are numerous methods for widening keratinized attached gingiva.

Purpose: This study is to present "Vertical Strip Gingival Graft Technique" as an attempt to improve methods of gingival augmentation.

Materials and Methods: In a before-after clinical trial 12 systematically healthy patients with no attached gingiva more than 0.5mm in at least 3 adjacent teeth were entered the study. After recipient bed preparation and harvesting free gingival graft (FGG), the graft was divided in two pieces and each part was fixed in one end of the bed. In this method an area with mean width of 6mm of recipient area, between two grafts, was remained uncovered. In order to determine the efficiency of this technique to augment attached gingiva the distance between stent to mucogingival line (MGL) and widths of attached gingival were used as indicator parameters. Clinical Parameters were measured using Wilcoxon sign rank test before surgery, 6 and 12 weeks after operation.

Results: The mean value of stent to MGL in the middle part (between FGGs) at the baseline, 6 and 12 weeks after operation were: 7.82 ± 2.61 mm, 11.53 ± 1.4 mm, 11.23 ± 1.1 mm respectively. The mean width of attached gingiva in those sites at the same intervals was as follows: 0.3 ± 0.2 mm, 3.72 ± 1.31 mm, and 3.41 ± 1.06 mm. Results showed significant increase in the width of attached gingiva ($P < 0.01$). The mean distance of stent to MGL between baseline and 6 week's data; and baseline and 12 week's also showed significant changes ($P = 0.001$).

Conclusion: With respect to the limitation of this study, by application of "vertical strip gingival graft technique" wider recipient site with less donor tissue can gain keratinized coverage. And as a result of producing smaller wound in the donor site (palate), patients would have less post surgical pain and discomfort.

Key Words: Mucogingival line; Graft; Free gingival graft; Strip; Gingival augmentation; Attached gingiva

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Treatment for the rehabilitation of width of attachment gingiva is known as "gingival augmentation" and has been practiced for many years as a part of mucogingival plastic surgery. During 1970s adequate width of attached gingiva was considered as an important factor for establishing the healthy periodontium.⁽¹⁾ However later studies on animals^(2,3,4) and human⁽⁵⁻⁸⁾ suggested that if gingival inflammation can be controlled; establishing a certain quantity of attached gingiva won't be necessary for maintaining of a healthy periodontium.

Despite all these studies, in some conditions such as: Progressing gingival recession⁽⁹⁾, orthodontic demands, inadequate depth of vestibule, frenum pull and abutment teeth in fixed or removable partial dentures,^(9,10) a wider attached gingiva is recommended.

Although various techniques for gingival augmentation has been introduced, Free Gingival Graft (FGG) is one of the most common and predictable methods, which was introduced by Bjorn in 1963 for the first time.⁽¹¹⁾ FGG effectively widened keratinized zone, however this method has disadvantages like producing two wounded sites and tissue limitation in donor site.

In order to overcome the donor tissue limitations, when a large area of attached gingiva is needed, other methods such as Accordion technique, and Strip technique have been introduced.⁽¹²⁻¹⁴⁾

The purpose of this study was to describe the "Vertical Strip Gingival Graft Technique" when gingival augmentation is required for wider recipient bed (at least 3 adjacent teeth). This method tries to overcome disadvantages of FGG technique.

Materials and Methods

In a before-after clinical trial 12 patients (9 females and 3 males) aged between 19 to 63 years with the mean age of 41 were selected. Each patient had attached gingival less than 0.5

mm with the minimum extension of 3 adjacent teeth and according to an experienced Periodontist's diagnosis, gingival augmentation was needed. All patients who participated in this study did not have any systemic diseases which might effect healing process and non of them had smoking problem. All the participants needed gingival augmentation not root coverage.

Operation areas in all patients were placed on the facial of teeth #20-29. None of participants in this study showed probing depth more than 2mm or any clinically appreciable gingival inflammation in the chosen experimental sites. All patients agreed and signed the consent form. All patients received initial and reinforced oral hygiene, scaling and root planning.

Clinical measurements

In order to standardize the measurements a stent was made for each patient. One person measured all parameters with vernier instrument. One of the parameters was the distance between stent to mucogingival line (stent to MGL), which was measured from a fixed point on the stent to the mucogingival line of each tooth at the operating site individually. The distance between stent and gingival margin (stent to GM) of each tooth was also measured and recorded in the same way. The probing depth of each tooth, on buccal side, in 3 points of mesial, distal and mid buccal was measured by Williams Prob. The width of keratinized gingival was calculated by subtracting the stent to GM from the stent to MGL. The width of attached gingival was also calculated by subtracting the salcular depth from keratinized gingiva.

The stent to MGL and widths of attached gingiva in the middle zone (between two grafts) were chosen as indicator parameters for determining the efficacy of this surgical method for widening the keratinized zone. Each patient's parameters were measured and recorded properly before operation, 6 weeks and 12 weeks after it. During the study, acrylic stents

were used as fixed references for all measurements.

Operation Procedures

After induction of local anesthesia, a recipient bed for free gingival graft with necessary extension, at least 3 adjacent teeth, was prepared by butt joint incision in the form of split thickness (gingival margins were removed completely) (Figs 1,2).

After preparing the bed, a graft with adequate size and about 1.5 mm thickness was harvested from the bicuspid area of palate by a partial thickness incision with a No. 15 blade. Then, the FGG was divided into two pieces and each piece was fixed on one end of the recipient bed (on mesial and distal end) by two bilateral 0-5 silk sutures and then stabilized by a tooth-suspended 0-3 silk cross suture (Figs 3).

Therefore an area with mean width of 6mm was left without any coverage between two FGGs and in these sites, only periosteum and a thin layer of connective tissue covered bone.

Post surgical treatment consisted of non-eugenol periodontal dressing which over the recipient and donor sites, the administration of analgesics and antibiotics (Amoxicillin 500 mg day for 7 days) and prescription of 0.2% chlorhexidine rinses twice a day for 3 weeks following the surgery. The dressing and sutures were removed 7-10 days after surgery. Home care instructions also were given to each patient. The findings were analyzed by nonparametric analysis of Wilcoxon-signed ranks test (Figs 4-6).

Results

The mean values and standard deviation of stent to MGL in the middle part of operation area (between two grafts) were 7.82 ± 2.61 mm, 11.53 ± 1.4 mm and 11.23 ± 1.1 mm before operation, 6 and 12 weeks after operation respectively (Table I). Wilcoxon signed ranks test showed significant differences in stent to MCL distance before and 6 weeks after surgery. This parameter also altered significantly before and 12 weeks after surgery ($P=0.001$).

The mean width of attached gingiva before surgery, 6 and 12 weeks after surgery were 0.3 ± 0.2 mm, 3.72 ± 1.31 and 3.41 ± 1.06 respectively (Table II).



Fig. 1- Pre operative view of two patients showing the lack of keratinized gingiva around facial aspect of teeth



Fig. 2- The bed was prepared by butt joint incision in the form of split thickness



Fig 3- Two grafts fixed on one end (mesial or distal) of recipient bed. An area remained without any graft coverage

Fig 5- Twelve weeks after operation



Fig 6- Post-operative view of one of the patients (after 1.5 year)



Fig 4- Six weeks after operation. Keratinized gingiva covered areas, which had no graft coverage

This test also showed attached gingiva changed significantly before and 12 weeks after surgery ($P < 0.001$).

Discussion

According to statistical analysis, the mean value of stent to MGL and width of attached gingiva increased significantly; which can be concluded that “Vertical Strip Gingival Graft” is a successful technique in gingival augmentation. Several studies have demonstrated that the specific Characteristics of gingival epithelium is determined by genetic factors which inherent in supporting connective tissue.⁽¹⁵⁻¹⁸⁾ However in this study, the areas without any

Wilcoxon signed ranks test showed significant difference in attached gingiva before and 6 weeks after surgery.

graft coverage gained keratinized gingiva similar to the adjacent grafted areas. In fact, in areas between grafts, keratinized epithelium covered the alveolar mucosa.

Although the previous studies ⁽¹⁵⁻¹⁸⁾ showed alveolar mucosa doesn't have the ability to induce keratinized epithelium, the results of the present study controvert the key role of connective tissue in differentiation of gingival epithelium.

However, there are studies, which support the results that obtained in the present study. In Accordion technique, areas without any grafts coverage, finally covered with keratinized epithelium regardless to their alveolar mucosa type.

Therefore, this hypothesis can be expressed that besides genetic factors in connective tissue, there are other factors which are important in differentiation of gingival epithelium.

Ainamo et al ⁽¹⁹⁾ suggested that, mucogingival line has a tendency to come back to its original position following surgical displacement. The reason which they have explained for of this movement after "apically repositioned flap" was the presence of muscular attachments apical of the MGL, which after having artificially repositioned, tend to push the MGL back towards its original location. However, there is not any explanation for apical displacement of MGL after other periodontal surgeries (for example after coronally repositioned flap)⁽²⁰⁾ So, what actually makes MGL return to its original position?

There is another possibility that the cells of the adjacent MGL exert a kind of strain on this displaced area to push it back to its previous

position along with the neighboring MGL. So, according to this hypothesis, it can be assumed that two free gingival grafts, existing on both sides of recipient bed, inhibited the effect of adjacent MGL cells on the healing of the area existing between grafts.

It should be noted that more studies are required to elucidate this subject. Despite all this ambiguities and unknowns, one point is obvious that following this method, so called "Vertical Strip Gingival Graft Technique", MGL displaced apical by compared to its pre-operative position and a significant (P=0.001) increase in the width of attached gingiva occurred.

So, by the limitation of this study; results suggest that by application of this method, wider keratinized coverage in the recipient site can be obtained by using less donor tissue. Therefore desirable results can be achieved through smaller wound in the donor site, which followed, by less pain and discomfort for the patients.

The distance between two grafts in this study was about width of a tooth, minimum and maximum distance between two grafts should be investigated through serial studies, and our study doesn't answer the optimum distance between grafts.

At last, it was suggested that more researches are needed to clarify real success rate and weak points.

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Table I - Mean and standard deviation of distance between stent to MGL before and after surgery.

Status	Average (mm)	SD*	Min. §§	Max. †
Pre-operation	7.82	2.61	4.5	10.5
Six weeks after operation	11.53	1.4	8.8	14.2
Twelve weeks after operation	11.23	1.1	9	13.5

*-Standard deviation

§- Minimum amount

†- Maximum amount

Table II- Mean and standard deviation of attached gingiva width before and after surgery.

Status	Average(mm)	SD*	Min.‡	Max.†
Pre-operation	0.3	0.2	0	0.5
6 weeks after operation	3.72	1.31	1.5	5.5
12 weeks after operation	3.41	1.06	1.5	4.5

*-Standard deviation

‡- minimum amount

†- maximum amount

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