A modified combined approach to harvest connective tissue grafts with high quality, less morbidity, and faster healing

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Abstract

Harvesting good-quality connective tissue grafts (CTGs) is important in periodontal surgery. Compared with CTGs, free gingival grafts (FFGs) have a slower healing process and higher donor site morbidity. As far as graft quality and anatomic limitations are concerned, deepithelialized free gingival grafts (DE-FFGs) are superior to CTGs. In the current study, a modified combined approach is proposed that aims to address the disadvantages of conventional FGG harvesting methods. This approach entails harvesting a thin and narrow DE-FFG, repositioning the epithelial layer, and applying a plastic stent. The outcomes of this improved method indicate fast healing at the donor sites, fewer postoperative complications, and better esthetic results at the recipient sites.

Introduction

The advent of esthetic dentistry has led to an increased use of soft tissue grafts obtained from the hard palate for periodontal plastic surgery. Two types of autografts are commonly harvested from the palate: the free gingival graft (FGG) and the connective tissue graft (CTG). The CTG is often the first choice over the FGG due to its superior esthetic result and high potential for primary healing at the donor site. Numerous techniques have been proposed for CTG harvesting that differ mainly regarding the harvesting tools, incision methods, and flap design used.

Several factors should be considered when choosing an appropriate technique, including the graft thickness and quality as well as the donor site morbidity. The first factor is the thickness of the graft that can be obtained from the hard palate. In a study of 62 Asian subjects, the mean thickness of the palatal masticatory mucosa measured by bone sounding ranged from 2.0 to 3.7 mm. For patients with an extremely thin palatal mucosa, alternative methods have been proposed to obtain a CTG for periodontal plastic surgery. Zucchelli et al. proposed the deep epithelialized free gingival graft (DE-FGG) as an alternative technique to harvest a CTG from a thin palate, and Carnio and Koutouzis attempted to increase the donor site thickness before surgery. The second factor is the graft quality. In addition to the gingiva portion and the rugae area, the hard palate is composed of three main components: the epithelium, the lamina propria, and the submucosa. The epithelial layer of the palatal mucosa is extremely thin, with an average thickness of 0.36 mm. Most CTGs harvested from the palate contain a partial submucosa with some lamina propria remaining at the donor site. In contrast, FGGs contain mainly lamina propria, with a reduced or absent submucosal layer.

The quality of a soft tissue graft has a high impact on clinical manipulation. Ouhayoun et al. indicated that DE-FGGs were easy to manipulate during the surgical and suturing processes, similar to an epithelial CTG. The third factor is postoperative complications. Compared with CTG harvesting, traditional FGG harvesting approaches are usually associated with a greater incidence of postoperative pain. However, Zucchelli et al. demonstrated no difference in postoperative pain, discomfort, and bleeding between patients who received a CTG and those who received a thinner FGG, possibly because only the superficial layer of the palatal mucosa was harvested in the latter approach. The patient’s morbidity is significantly reduced when autogenous soft tissue grafts are harvested from the superficial area rather than from the deeper portions of the palatal mucosa. When considering postoperative complications, various sheltering appliances and hemostasis approaches have been proposed. The shel-
tering devices have been shown to be helpful for pain control at donor sites.8,10,13 Individuals with a thin and fragile gingiva often have a thin palatal mucosa.17 For this type of patient, DE-FGG might be a better approach for CTG harvesting. Based on the above considerations, the aim of the present article is to propose a modified combined method for atraumatic harvesting of autogenous soft tissue grafts from the hard palate with a high graft quality, fewer complications, and faster healing.

Surgical procedure

All patients were instructed to maintain good oral hygiene before the surgery (Fig 1). A transparent acrylic stent was fabricated based on a maxillary stone cast (Fig 2). The stents were adjusted for fitness and retention before surgery. All the surgeries were performed by the same periodontist under local anesthesia with 2% lidocaine with epinephrine at a 1:100,000 ratio. Following the preparation of the recipient site, an appropriately sized FGG was harvested from the palate. The length of the FGG depended on the needs of the recipient site, while the width of the FGG was limited to 6 mm due to anatomic limitations and patient morbidity.18-20 An initial incision on the palate was made with a no. 15 blade approximately 2 mm apical to the gingival margin of the maxillary teeth. Two vertical incisions were made at the mesial and distal ends of the initial incision, extending 6 mm in an apico-coronal direction. Based on the thickness of the graft required for surgery and wound healing, the depth of all incisions was restricted to 1.5 to 2 mm. A split-thickness flap with a uniform thickness was carefully raised using sharp dissection from the edges of the incisions. The final incision was made parallel to the initial incision to detach the FGG from the palate.

The next step was deepithelialization, which was carried out by separating the graft into epithelial and connective tissue layers. The epithelium was removed using a technique whereby the surgeon used the left hand to hold and stabilize both the graft and a piece of wet gauze, while using a new no. 15 blade to separate the epithelial layer (Fig 3). Special care should be taken to maintain an approximate 0.5-mm thickness and to ensure that the epithelium remains intact during dissection to avoid any epithelial remnant. Then, the DE-FGG was transferred to a dish and dipped in saline solution for later use. The epithelium was repos-
itioned at the donor site and stabilized with 6-0 nylon sutures. The surgery was then completed with the application of the graft to the recipient site. Postsurgically, each patient was advised not to brush the surgical site and to use a 0.12% chlorhexidine gluconate mouth rinse twice a day for 1 min during the first 2 weeks. Each patient was prescribed 400 mg ibuprofen (8 pills) and was instructed to keep the stent in place for 2 weeks while sleeping and as required during the day to minimize discomfort. The sutures were removed approximately 2 weeks after the surgery.

The biopsy specimens from three patients were processed, stained with hematoxylin and eosin, and observed under a light microscope at 10x magnification (Figs 4 and 5). The histological analysis confirmed that this method successfully removed all of the epithelium and obtained a good-quality graft.

Case reports and comparison

In a period of 1 year, a total of 20 patients underwent periodontal plastic surgery using this modified combined approach to harvest soft tissue grafts. The objective evaluation of the healing at 10 to 15 days postsurgery was assessed by an independent periodontist who was not involved in the surgery. The complete reepithelialization was assessed by means of color photographs and was based on the degree of color match, tissue texture, and contour of the surface compared with the adjacent tissue. All the donor sites except one showed complete reepithelialization at 10 to 15 days postsurgery; the one exception showed 95% reepithelialization (Table 1). The healing outcome of three patients (nos. 2, 8, and 9) are summarized in Figure 6. The clinical photographs show impressive healing at the palatal donor site at the 2-week follow-up.
after harvesting an FGG that was >2 cm in length (Fig 6e). The newly formed epithelium appeared pinkish and firm and was consistent with the architecture of the adjacent palatal mucosa.

**Patient 1:** A 50-year-old Asian female with well-controlled type II diabetes melitus presented with a Miller Class I gingival recession at the mandibular right second premolar and first molar (Fig 7a) and a thin palate (Fig 7b). The clinical examination revealed a minimal probing depth and no bleeding on probing (BOP). At the time of surgery, the recipient site was prepared by tunneling the papillae using a split-thickness dissection with a micro blade. Thorough root planing was performed over the denuded root surfaces. An appropriately sized FGG was harvested from the palate. Then, deep epithelialization and replacement of the epithelium at the donor site were performed according to the techniques already described (Fig 7c, d, and f). Next, the DE-FGG was inserted into the partial thickness tunnel of the recipient site. Both the DE-FGG and the flap were positioned with sutures (Fig 7e). The postoperative care and prescription were the same as those previously described. The course of postoperative recovery was smooth and without obvious pain and hemorrhaging. The sutures were removed 14 days after surgery, and both the donor and recipient sites showed good healing (Fig 7g and h). After 6 months of postoperative healing, the root coverage was almost 100% at both

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* 10 to 15 days postsurgery.

**Table 1.** The FGG dimensions and the donor site healing outcomes of all 20 patients; all sites showed complete reepithelialization at 10 to 15 days postsurgery except one (no. 4), which showed 95% reepithelialization.
Fig 6  The palatal donor sites of three patients (nos. 2, 8, and 9). (a) Initial photograph of the donor site. (b) Harvested thin, narrow FGG with a length of > 2 cm. (c) After the deepithelialization step, the graft was separated into a DE-FGG (upper strip) and an epithelial layer (lower strip). (d) The epithelium was repositioned at the donor site and stabilized with 6-0 nylon sutures. Sometimes, simple interrupted sutures can be applied at the medial or distal margins. (e) Two weeks after the harvesting of the FGG, the sutures were removed, with the donor site showing good healing.
sites, with minimal probing depths, no inflammation, and a favorable esthetic result (Fig 7i and j).

Patient 2: A 42-year-old Asian female presented with bilateral gingival recession of the mandibular first premolar and the mandibular right first premolar with buccal version (Fig 8a and b). A root coverage procedure of the right and left mandibular first premolars was performed with a DE-FGG (Fig 8c) and a CTG (Fig 8d), respectively. The FGG harvesting, deepithelialization, and suturing steps were executed as described previously (Fig 8e). The left palatal donor site was sutured after a piece of CTG was obtained using the single-incision technique (Fig 8f). Both grafts were inserted into the tunnels of the recipient sites and positioned with a sling and simple interrupted sutures (Fig 8g and h). The postoperative period was uneventful. Two weeks after surgery, healing was almost complete and the sutures were removed (Fig 8i, j, k, and l). Both donor sites showed good healing, with the right site (DE-FGG) showing better healing than the left site (CTG). At 1-month postsurgery, the root coverage results of both sites were stable, with minimal probing depths, no inflammation, and a favorable esthetic result (Fig 8m and n).

Fig 7 Patient 1 was a case of root coverage with a DE-FGG. (a) A Miller Class I gingival recession at the mandibular second premolar and first molar. (b) The preoperative clinical photograph of the maxillary right palate. (c) The harvested FGG with a size of approximately 22 x 6 x 1.5 mm. (d) After the deepithelialization step, the graft was separated into the DE-FGG (upper strip) and epithelial layer (lower strip). (e) The DE-FGG was inserted into the tunnel of the recipient site. Both the graft and flap were positioned with sling sutures. (f) The epithelial layer was repositioned at the donor site and stabilized with 6-0 nylon sutures. (g and h) The sutures were removed 2 weeks after the surgery. Both the recipient and donor sites showed good healing. (i and j) The clinical photographs at the 6-month follow-up showed stable root coverage results.
Discussion

The palatal masticatory mucosa is widely used as the donor material in periodontal plastic surgery. One contraindication for CTG harvesting is palatal areas that fail to provide an adequate donor CTG. Carnio and Koutouzis attempted to increase the donor site thickness using a collagen sponge inserted between the flap and the bone. Eight weeks later, a second surgery was performed to harvest the newly formed tissue for root coverage. The thickness of the palatal mucosa adjacent to the palatal root of the first molar was thinnest (approximately 2 mm on average) and presented an anatomical barrier in CTG harvesting. However, a long piece of FGG can be obtained from the anterior palate to the tuberosity in most patients. For patients with a 2-mm-thin palatal mucosa, DE-FGG might be an appropriate alternative approach for harvesting a CTG because a piece of FGG with a 1.5-mm thickness can be obtained from the hard palate without disturbing the periosteum, and a piece of DE-FGG with a 1-mm thickness can be obtained by removing the epithelial layer. If a thicker graft is needed for the surgery, folding a long, thin graft could be a useful alternative method.

Zucchelli et al observed an excellent healing process at the palatal donor site after harvesting a small piece of FGG for an isolated gingival recession, while the present study shows impressive healing at the palatal donor site after harvesting a > 2-cm-long FGG. This result is a useful finding for clinicians because patients with a thin gingiva might have more than one soft tissue problem such as multiple gingival recessions, lack of a keratinized gingiva, and a ridge deficiency. If a longer graft can be harvested and used to solve all the problems during one surgery, the risk of the patient undergoing multiple surgeries is reduced.

Fig 8 Patient 2 was a case of mandibular right and left root coverage with a DE-FGG and CTG, respectively. (a and b) The mandibular bilateral first premolars showed gingival recession. (c) A piece of the DE-FGG (lower strip) and the resected epithelium (upper strip). (d) A small piece of the CTG was obtained using the single-incision technique. (e) The resected epithelium was repositioned with sutures at the right palatal donor site. (f) The left palatal donor site underwent primary closure with sutures. (g and h) Both grafts were inserted into the tunnel of the recipient sites and positioned with 6-0 nylon sutures. (i and j) The sutures were removed 2 weeks after the surgery. Both donor sites showed good healing, with the right palatal donor site (DE-FGG) showing better healing than the left site (CTG) (Fig 8 continues on the next page).
Different techniques exist for the depepithelialization step. The epithelium of an FGG can be removed using a diamond bur or diode laser before detaching it from the palate. One could also use a blade after harvesting the FGG from the palate. The present study used a new no. 15 blade to detach an intact piece of epithelium and obtain a piece of graft with a smooth texture. The histological examination proved that this method could be used to remove all of the epithelium, since the epithelial thickness was approximately 0.2 mm, and no significant difference was observed between the thin and thick biotypes. Sometimes, discarding the lateral border will help to avoid any epithelial remnants. Although the inclusion of some epithelium did not seem to affect the clinical results in terms of root coverage, complete removal of all the epithelium helps to avoid possible complications.

Healing of the palatal donor site normally takes approximately 2 to 4 weeks. Del Pizzo et al evaluated early wound healing of the palate and showed that only 50% of the FGG group achieved complete epithelialization at the 3-week follow-up. Femminella et al protected the palatal donor site with a platelet-rich fibrin (PRF) membrane, which resulted in complete reepithelialization in 35% of recipients at the end of the second week. Ozcan et al showed that complete epithelialization of palatal wound healing after FGG harvesting protected with PRF with butyl cyanoacrylate adhesive was seen in 85.7% of recipients at the 2-week follow-up. Although both studies show accelerated healing through the use of PRF at the donor site, the benefits of PRF need to be confirmed by further histologic and mechanical studies. The present report showed impressive wound healing at the donor sites, and resulted in 95% complete reepithelialization at 10 to 15 days postsurgery. This fast healing process might contribute to rapid revascularization of the uniform thin epithelium, which accelerates nutritional perfusion.

No perfect soft tissue harvesting method exists. The single-incision technique for CTG harvesting shows fast healing but reduced visibility, which can prolong the harvesting of the graft and may lead to a lower predictability of the graft size. Compared with FGG harvesting, that for CTGs usually results in deeper tissue trauma that is related to a higher risk of vessel injury, delayed healing, and more postoperative complications. Considering the course of the greater palatine artery, harvesting a thin FGG that is 6 mm in width is relatively less stressful for the surgeon because the surgical wound is located far from the danger zone.

The main disadvantages of FGGs are secondary healing at the donor site and the relative discomfort suffered by patients. The 2007 article by Bosco and Bosco was the first study attempting to promote faster healing and reepithelialization at donor sites.
by epithelial replacement. The present author appreciated the results from their case report and made some modifications to achieve a quicker and better healing outcome. The present method emphasizes the importance of careful removal of the entire epithelium as an intact layer; therefore, the graft is held to separate the overlying epithelial layer instead of placing it on the table for the procedures. And the whole epithelial layer is positioned with sutures for proper adaptation and stabilization to completely cover the donor site. Moreover, an acrylic stent is substituted for a periodontal dressing to protect the donor site in order to reduce postoperative discomfort and facilitate wound healing.

Conclusion

The presented method may be suitable for CTG harvesting for patients with a thin or thick biotype. The modified combined approach proposes harvesting an FGG with an appropriate thickness and then detaching the epithelium extrarorally to avoid deep trauma. With this approach, repositioning the epithelium at the donor sites and applying a sheltering stent accelerated the healing process at the donor sites and reduced patient morbidity.

References