A Single-Incision Technique to Harvest Subepithelial Connective Tissue Grafts from the Palate

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This article describes a new and simplified surgical approach to harvest subepithelial connective tissue grafts from the palate. For this procedure, only a single incision parallel to the gingival margin is used to access the donor site for graft preparation and harvesting. Grafts of variable size and thickness can be obtained. Since no band of epithelium is removed with the connective tissue graft the palatal donor site can heal with primary intention. No stents or hemostatic agents are necessary to cover the donor area postoperatively, and suturing can be reduced to a minimum. The harvesting technique is illustrated step by step, and the clinical application of connective tissue grafts harvested with the proposed method is demonstrated with the coverage of a gingival recession. (Int J Periodontics Restorative Dent 1999;19:279-287.)

The use of subepithelial connective tissue grafts (CTG) has significantly broadened the therapeutic spectrum of esthetically oriented dentistry. Since its first introduction in 1974 by Edel1 as a means for increasing the gingival width, the application of CTGs has developed over the years to become the treatment of choice. In periodontal and implant plastic surgery the CTG has become an important aspect of the treatment options for gingival recessions,2-19 existing or imminent ridge deficiencies,20-27 periimplant tissue management,28-30 furcation involvement,31-32 and thin gingiva.33 In minor ridge deficiencies of edentulous areas or surrounding implants, the CTG is an inexpensive means to increase the height of the ridge or to improve the facial contour of the alveolar process. Compared to autogenous bone harvesting, a CTG involves less invasive surgery in the donor site and shorter healing periods. When employed for gingival
recession treatment, the CTG receives a double blood supply from both the overlying pedicle flap and the underlying periosteum. A free gingival graft, however, will be nourished only by the periosteal recipient bed. The color match of the neighboring soft tissues seems to be better with a CTG than with a free gingival graft, and long-term results in terms of root coverage also favor the CTG. Whereas the donor site of a free gingival graft always has to heal with secondary intention, the donor area of a CTG can heal with primary intention, depending on the technique used for harvesting.

Numerous procedures for harvesting a CTG have been described, all of which differ in the number of incisions, flap design, and the technique for gaining access to the graft. They can be divided into techniques that provide CTGs with or without a remaining band of epithelium.

With regard to the group of harvesting techniques that produce a CTG with an epithelial band, Langer and Calagna and Langer and Langer presented methods that were designed to obtain CTGs suitable for ridge augmentation and for root coverage, respectively. For root coverage purposes only, the epithelium was kept and transplanted to the recipient site. In this procedure, a rectangular incision design with 2 horizontal and 2 vertical incisions was used, leaving a 1.5- to 2.0-mm collar of epithelium. The epithelial band was to provide a smoother junction with the existing epithelium. In a similar approach by Harris, a scalpel with parallel blades was employed for the horizontal incisions that bordered the epithelial collar. Vertical releasing incisions, however, were reduced to the minimum necessary for reflecting the outer flap and gaining access to the underlying donor tissue. Raetzke harvested a palatal CTG with 2 crescent-shaped horizontal incisions that converged in the depth of the palatal mucosa. Thus a wedge of connective tissue could be removed with an epithelial collar that has to be partially deepithelialized. The common finding with all of these techniques that obtain a CTG with parts of the epithelium is an uncovered part of the donor area that has to heal by secondary intention. This is because of the rigidity of the palatal masticatory mucosa, which does not allow for a complete closure of the donor site.

Edel employed a trap-door approach without removing epithelium from the donor site. After removal of the CTG, complete closure of the donor site was possible. In trap-door approaches with 3 incisions, care has to be taken not to compromise the blood supply of the flap. In cases where the relationship between flap base and pedicle length is shifted toward the latter, flap sloughing may result, causing unnecessary discomfort for the patient. Even in cases where the base of the flap seems to be wide enough, sloughing may occur.

The purpose of this article was to present a new technique for harvesting a CTG. This technique attempts to simultaneously combine the tissue gain of large grafts with unimpaired wound healing and patient comfort by primary intention healing in a single-incision approach.

Surgical technique

A rectangular area delineates the anatomic area of the palatal masticatory mucosa considered to be a suitable donor site. The anterior and posterior borders of this rectangle are located in the canine region and at the palatal root of the first molar, respectively. Studer et al demonstrated that the palatal root of the first molar represents a natural barrier to graft harvesting because the tissue is thinnest in this area. The lateral border is formed by a horizontal line 2 mm from the palatal gingival margin. In the medial direction the rectangle is limited by the position of the neurovascular bundle. According to Reiser et al, the
The neurovascular bundle can be found at a distance of 7, 12, or 17 mm from the palatal cementoenamel junction of the corresponding teeth depending on whether the palatal vault is classified as shallow, average, or high. An appropriate distance should be kept from the palatal artery and nerve to avoid intraoperative complications.

After preparation of the recipient bed, the donor area in the palate is anesthetized by block anesthesia of the greater palatine and nasopalatine nerves with a local anesthetic agent containing epinephrine. The anesthetic agent should not be infiltrated into the palatal mucosa of the donor area itself to avoid transplanting the vasoconstrictor with the CTG. A #15 scalpel blade is used to make a single horizontal incision to the bone 2 mm from the gingival margin (Fig 1). The length of this incision corresponds to the purpose for which the graft is intended. The angle of the blade is 90 degrees to the bone. After the first incision the blade is angled to approximately 135 degrees, and an undermining preparation toward the median is started within the first incision (Fig 2). With each new movement of the scalpel along the incision line, the angle is further flattened until the blade reaches a nearly parallel position to the bone surface. The partial-thickness preparation should be observed from the outside without trying to elevate the tissue while cutting with the blade. The position of the blade underneath the surface can thus be controlled to prevent any tissue perforation. This is continued until the undermined area reaches the size of the graft (Fig 3). No vertical incisions are to be made. The goal of this procedure is to create a partial-thickness mucosal flap with a uniform thickness of 1 to 1.5 mm, depending on the needs for the recipient site.

The underlying CTG is separated from the surrounding connective tissue by making incisions to bone on the mesial, distal, and medial sides of the graft. The graft can then be removed by detaching it from the bony surface with a periosteal elevator (Fig 4). With this technique a graft of between 1.5 and 2.9 mm in thickness can be obtained (Fig 5). After its removal from the palate, the CTG is placed on saline-soaked gauze and kept wet until its transfer to the recipient site. Before the donor site is sutured, a collagen material (e.g., Avitene, Davol) can be placed tentatively in the void where the CTG has been removed to maintain the outer contour of the palatal mucosa after healing. The use of only one incision with no epithelium removed facilitates the readaptation of the separated tissue. The 90-degree angle of the blade to the bone during the first incision creates butt joints. Instead of interrupted sutures at the incision lines, horizontal suspension sutures are used to simultaneously secure both the flap margins and the entire undermined donor area. These sutures can be parallel and/or crossed (Fig 6).

Postoperatively, a stent is not necessary because no secondary intention healing is expected. The patient is prescribed a nonsteroidal anti-inflammatory medication and is instructed to rinse with chlorhexidine 0.12% twice daily. Sutures can be removed after 7 to 10 days (Fig 7).
Fig 1. Incision is made at a 90-degree angle to the bone, 2 mm away from the gingival margin.

Fig 2. Incision angle is changed to 135 degrees and the undermining preparation is started toward the median.

Fig 3. Preparation is continued until a graft of the necessary size is outlined. Note the almost parallel position of the blade relative to the bone.

Fig 4. Periosteal elevator is used to detach the graft from the bone surface.

Fig 5. Graft is removed after incising the mesial, distal, and medial borders.

Fig 6. Crossed and parallel horizontal suspension sutures secure the incision and the donor site.
Case report

A 23-year-old woman presented with gingival recession associated with sensitivity on the mandibular left canine (Fig 8). Clinical examination revealed thin periodontal tissues and less attached gingiva on the facial aspect of the left canine compared to the neighboring teeth. A double-papilla flap in combination with a CTG was the treatment of choice. This procedure allows not only coverage of the recession defect with gingiva, but also predictably increases the amount of keratinized tissue on the facial aspect after treatment.

Two partial-thickness flaps were reflected within the adjacent papillae. A subepithelial CTG was then harvested from the left palate with the previously described technique, trimmed, and adapted to the defect. After adaptation the CTG was held in position with a biodegradable suture. The two partial-thickness flaps were laterally positioned over the graft and sutured into place with a nonresorbable suture. Four months posttreatment, the initial hypersensitivity had been completely resolved, and the previously exposed root surfaces had remained covered with normal, healthy-looking gingival tissues (Fig 9).
Discussion

The single-incision technique described for harvesting a CTG provides grafts without a band of keratinized epithelium. Originally, the epithelial collar of a CTG was used to provide a smoother junction with the existing epithelium and a more consistent color blend in the treatment of gingival recessions. From an esthetic viewpoint, however, keeping the epithelial band did not seem to provide better results than CTGs without epithelium. Furthermore, since it is known that the epithelialized part of a gingival graft will degenerate and desquamate during the first 5 postoperative days, the formation of new keratinized tissue depends on the survival of the underlying connective tissue part of the graft only. This gingival connective tissue has been shown to carry the potential to induce keratinization in newly forming epithelium. Therefore, an increase in gingival width will occur in either case as long as the connective tissue part of the graft survives. The net gain of keratinized tissue primarily depends on the vertical height of the CTG that is not covered by the overlying coronally or laterally positioned flap but still survives. However, even if a CTG without an epithelial collar is covered completely by a pedicle flap, an increase in keratinized tissue height will occur.

For purposes other than coverage of gingival or peri-implant recessions, or when the CTG will be placed in a submerged location, the epithelium has to be excised anyway and therefore does not influence the treatment outcome.

Any removal of epithelium from the palatal masticatory mucosa leads to an uncovered wound area, which has to heal by secondary intention. The rigidity of the palatal mucosa prevents coverage of the de-epithelialized area by pulling neighboring tissue over it. This creates additional discomfort for the patient, and stents, covering, and/or hemostatic materials have to be applied to address this issue.

Graft harvesting techniques that use a trap-door approach to raise a split-thickness flap generally provide good access and visibility of the underlying connective tissue. However, the more incisions made, the more reduced the blood supply for the flap will be. Therefore, general nutritional guidelines for flaps should be followed. In cases where the length of the flap is greater than the base of the flap, the blood supply is seriously compromised and necrosis of the flap may result. This may occur even when the base seems to be wide enough compared to the pedicle length. In this case, secondary healing has to
occur over a significantly large area. In addition, more incisions usually require more sutures, and vertical releasing incisions in the palate should be closed with interrupted sutures.\textsuperscript{19,29,30}

The use of parallel blades is a fast way to harvest a CTG with a uniform thickness throughout the whole graft. However, the predetermined thickness of the graft can also become a restriction when more flexibility is desired, for instance when the palatal vault is shallow, when a palatal torus is present, or when the thickness of the available donor tissue is limited. To harvest a sufficiently large CTG, the double-bladed knife must then be aligned as parallel as possible to the bone surface. This results in a larger deepithelialized palatal wound area. In addition, the parallel-blade technique always leaves remaining connective tissue on the bone, whereas the single-incision technique harvests the full amount of connective tissue beneath the undermined masticatory mucosa.

**Conclusion**

The single-incision technique for CTG harvesting provides grafts that are suitable for all submerged and nonsubmerged indications. The advantages of this technique are:

- Only one incision is necessary parallel to the gingival margin.
- There is an uncompromised blood supply for the overlying flap.
- The number of sutures needed is reduced.
- No postoperative stents or hemostatic agents are required.
- There is primary intention healing of the donor site incision.
- Variable graft sizes are obtainable.
- The technique is applicable to different anatomic situations of the palatal vault.

A possible shortcoming of this technique is the reduced visibility of the donor site during graft preparation.
References


