Palatal Pedicle Flaps for Soft Tissue Augmentation

Several approaches for peri-implant soft tissue augmentation have been proposed, including autogenous soft tissue grafts and substitutes. Palatal pedicle flaps have been introduced for increasing facial soft tissue thickness, improving esthetics, and achieving primary closure following alveolar ridge preservation or guided bone regeneration. The main advantage of these approaches is to maintain the vascularization of the flap, which may result in better healing and less shrinkage than graft-based procedures. Nevertheless, different clinical scenarios require different palatal pedicle flaps. The aim of this article was to present several palatal pedicle flap techniques for peri-implant soft tissue augmentation and alveolar ridge preservation, showing flap designs and the main advantages through case presentations. Int J Periodontics Restorative Dent 2020;40:581–588. doi: 10.11607/prd.4561

Remodeling the alveolar ridge after tooth loss includes a series of biologic events that can negatively affect the underlying bone and soft-tissue component. It has been demonstrated that more than 51% of hard and soft-tissue remodeling occurs within the first 2 weeks, regardless of the tissue phenotype.1 Several techniques have been proposed that include different combinations of bone grafts and membranes and aim to minimize the dimensional changes that occur due to bone remodeling after tooth loss.2 Nevertheless, these approaches are not always effective in maintaining the soft tissue architecture, which, given the increasing importance of patient-reported outcomes, plays a key role in modern dentistry.3 In addition to esthetics, tissue thickness and width of keratinized mucosa (KM) can also positively affect peri-implant health and marginal bone remodeling.4,5 Therefore, it is not surprising that several soft tissue augmentation techniques have been described in the literature, using autogenous soft tissue grafts, collagen matrices, and the acellular dermal matrix.6,7 The autogenous grafts are shown to be the gold standard material in terms of KM gain, increase in mucosal thickness, and improvement in bleeding indices.4 It has been suggested that palatal pedicle flaps can improve the outcomes of autogenous soft tissue...
grafts by maintaining the vascularization of the palatal flap, which results in higher color match and less shrinkage. Several approaches for the palatal pedicle flap have been introduced and modified over the years for increasing KM width and thickness at the facial aspect of dental implants or for achieving primary closure following alveolar ridge preservation or guided bone regeneration. Thus, the aim of this article is to present several palatal pedicle flap techniques for peri-implant soft tissue augmentation and alveolar ridge preservation, demonstrating the flap designs and the main advantages through case presentations.

Materials and Methods

Patients presenting with a lack or minimal amount of keratinized tissue width at an implant site, a thin or very thin gingival phenotype at an implant site, or a hopeless tooth with a compromised alveolar socket presenting with either a complete or partial loss of the buccal wall were screened for inclusion. The study protocol was in accordance with the Declaration of Helsinki of 1965, revised in Tokyo in 2004. The surgeries were performed by one experienced periodontist (E.T.) at a private practice in Taipei, Taiwan.

Case 1

A 73-year-old woman presented with a fractured maxillary right central incisor. During the second-stage implant surgery, a rotated split-thickness palatal flap was executed for increasing the peri-implant mucosal thickness and improving the esthetics (Fig 1). Two full-thickness vertical incisions were performed 2 mm towards the buccal aspect and 3 to 4 mm towards the palatal side, then connected with one horizontal split-thickness incision. In order to preserve the papillae, the incisions were made 1 mm away from the proximal soft tissue of the adjacent teeth (Fig 1a). A palatal split-thickness flap (approximately 1 mm thick) was reflected to expose the underlying connective tissue. An apical cut was performed on the palatal aspect to free the pedicle flap, which was then raised using a small periosteal elevator (Fig 1b). The pedicle flap was rotated and rolled into the facial aspect where a tunnel technique was performed (Fig 1c). The pedicle flap was then inserted in the pouch and stabilized with simple interrupted and horizontal mattress sutures (6-0 nylon suture) (Figs 1d and 1e), while the primary palatal flap was adapted and sutured over the exposed bone, allowing healing by first intention (Fig 1f). The healing was uneventful.

Case 2

A 55-year-old woman was referred with a chief complaint of missing teeth in the left posterior maxilla. Extraction and alveolar ridge preservation were planned for the first molar, as it was deemed unrestorable. Partial loss of the buccal wall was seen after extraction. After degranulation of the socket, rectangular incisions were made on the left palate (Fig 2a). A split-thickness epithelialized palatal flap was raised and then rotated towards the socket by performing a cut-back incision at the base of the pedicle flap (Fig 2b). The residual socket was filled with 1 cm³ of allogenic bone graft (Puros, Zimmer Biomet) hydrated with the patient’s own blood (Fig 2c). The socket was then sealed by rotating the split-thickness palatal pedicle flap, which was sutured to the adjacent facial soft tissue using simple interrupted sutures (6-0 nylon suture) (Fig 2c). A hemostatic collagen sponge (Collagen Tape, Zimmer Biomet) was placed over the palatal donor site with cross mattress sutures to minimize the patient’s postoperative pain. The healing was uneventful, and at the 2-week recall, the patient did not report significant pain (Fig 2e). At the 3-month postoperative follow-up, an adequate soft tissue thickness had been achieved (Fig 2f).

Case 3

A healthy 64-year-old woman presented with an old partial denture supported by a fractured maxillary left central incisor (Fig 3a). Atraumatic extraction with debridement of the socket was performed. A complete loss of the buccal plate and facial gingiva was observed (Fig 3b). The tunnel technique was performed to create a pouch in the facial aspect for the insertion of a pedicle palatal flap that was created with three incisions (coronal, apical, apical,
Fig 1 Palatal pedicle flap for peri-implant facial soft tissue augmentation. (a) Incision design. (b) An apical cut is performed to free the palatal pedicle flap. (c) The implant is exposed, and the flap is rotated on the facial side. (d and e) The pedicle flap is inserted in the pouch created in the facial aspect and sutured. (f) Occlusal view at 10 days postoperative.
and a cut-back). The socket was slightly overfilled with an allogenic bone graft (Puros) that was hydrated with the patient's own blood. A primary palatal flap was created by performing a single incision on the palate extending until the first-molar area. A connective tissue palatal flap was then obtained by dissecting the deeper layers of the palate (Fig 3c), rotated anteriorly and inserted into the pouch to completely cover the defect and the bone graft material (Fig 3d). The pedicle was secured with interrupted and mattress sutures.

Fig 2 Palatal pedicle flap in combination with alveolar ridge preservation. (a and b) Extraction of the maxillary first molar and palatal pedicle flap design. (c) The flap is raised full-thickness, and the epithelial layer is preserved. A hemostatic collagen sponge is adapted and sutured over the donor site while the socket is grafted with allogenic bone graft. (d) Simple interrupted sutures were performed to stabilize the palatal flap over the grafted socket. (e) Healing at 12 days postoperative. (f) Clinical view at the 8-week follow-up.
Fig 3  Palatal pedicle flap in combination with alveolar ridge preservation. (a) Situation at baseline. (b) Socket with the complete loss of the buccal plate and facial gingiva. (c) Pedicle flap preparation. (d) Rotation of the pedicle flap to cover the grafted socket. (e) Suturing of the palatal pedicle flap to completely seal the socket. (f) Healing at 1 week postoperative. (g) Clinical view at the 6-month follow-up.
sutures (Fig 3e). Healing was uneventful (Fig 3f). The 6-months postoperative follow-up demonstrated a greater improvement in terms of esthetics and soft tissue thickness, although a mild horizontal and vertical ridge defect was still present (Fig 3g).

**Case 4**

A healthy 51-year-old man presented with a limited mucosal thickness on the right posterior maxilla, where two implants were previously inserted to replace the missing second premolar and the first molar (Fig 4a). The thickness of the palatal fibromucosa was measured with an endodontic stop placed over the injection needle to evaluate whether the thickness was at least 4 to 5 mm, which is fundamental for performing this technique. At the second-stage surgery, conventional papillae-preserved incisions were performed to uncover the implants. On the palatal aspect, the vertical incisions were extended 5 to 6 mm. An internal bevel, horizontal split-thickness incision was performed on the crest, 2 mm coronal to the most apical end of the vertical incisions (Fig 4b). An external bevel, horizontal partial-thickness incision was then made at the apical end of the vertical releasing incisions in an apico-coronal direction to obtain a palatal flap 3 to 4 mm in height. It is crucial (1) to keep these two beveled incisions at different levels, and (2) that they never meet under the palatal mucosa. While the buccal flap stayed in its original position and maintained the vestibular depth, the palatal flap was repositioned coronally without tension and was further trimmed for a better soft tissue adaptation around the implants (Fig 4c). Simple interrupted sutures were used to stabilize the flaps, while the most apical part of the palatal donor site was left exposed and healed by secondary intention (Fig 4d). A periodontal wound dressing material was then applied on the surgical area. The follow-up at 10 days showed an optimal and uneventful healing (Fig 4e), while good amounts of peri-implant soft tissue thickness and KM were observed in the subsequent follow-up appointments (4 weeks, 3 months, 6 months, and 1 year) (Fig 4f).

**Discussion**

It has been shown that soft tissue thickness and KM width play a crucial role in maintaining the peri-implant health and marginal bone stability. While the timing of soft tissue augmentation (whether at the time of implant placement or 3 to 6 months later) was found to be unrelated to the amount of KM and midbuccal mucosal recession, several studies have compared grafted and nongrafted sites and found KM to be beneficial at implant sites. Nevertheless, several disadvantages for autogenous soft tissue grafts have been described, including the relatively high shrinkage rate and the possibility of necrosis. For these scenarios, palatal pedicle flaps that partially maintain the vascularity of the flap have been proposed to increase peri-implant soft tissue quality and thickness as well as seal augmented sockets after extraction. Tinti and Parma-Benfenati introduced the coronally positioned palatal sliding flap to cover barrier membranes during guided tissue regeneration and implant surgery. Nemcovski et al described the palatal rotation flap (either split- or full-thickness) and suggested that flipping the periosteum over the packed bone graft may act as a barrier that promotes bone regeneration. In line with this speculations, the vascularized interpositional periosteal connective tissue flap has been described for soft tissue augmentation in the esthetic area. Regardless of the name and the preparation (split- or full-thickness) of the pedicle flap, the main advantage of these techniques is to maintain the vascularization of the flap, which can be obtained with (when covering the socket) or without the epithelial layer, allowing for primary-intention healing of the donor site.

In the present case series, all patients had uneventful healing with no or minimal postoperative pain. It can be speculated that the morbidity following palatal pedicle flaps may be similar to those described for autogenous grafts. Similarly to harvesting soft tissue grafts, a thorough knowledge of the palatal anatomy is mandatory. Another advantage of the palatal pedicle flaps compared to autogenous grafts is the preservation of the level of the facial mucogingival junction, which is usually coronally advanced when grafts are performed. However, the need for additional skills and case selection...
are among the limitations of palatal pedicle flaps. Indeed, the presence of thin palatal fibromucosa, small palatal vault, and/or palatal tori may be contraindications of these techniques.\textsuperscript{9,10} Within the limitations of the present study, the limited number of patients treated with different pedicle flap designs for diverse surgical purpose has to be mentioned. However, the aim of this article was to illustrate the indications and advantages of palatal pedicle flaps for soft tissue augmentation through a series of case presentations.

Fig 4 Palatal pedicle flaps for increasing the soft tissue thickness at the facial aspect of two implants during the second-stage procedure. (a) Situation at baseline. (b) Incisions and buccal flap elevation. (c) An apical cut was made to coronally advance the palatal flap that was adapted to the implants’ abutments. Note that a subepithelial connective tissue graft was harvested from the deeper layers of the palatal aspect and moved to the facial side. (d) The sutured surgical site. (e) Healing at 1 week postoperative. (f) Clinical view at the 4-follow-up.
Conclusions

The present article provides case presentations of palatal pedicle flaps to fulfill the different clinical scenarios when soft tissue augmentation or complete soft tissue coverage is needed. Further studies comparing palatal pedicle flaps to autogenous graft or substitutes are needed to assess the efficacy of these techniques in (1) increasing the thickness of soft tissue and KM and (2) improving the esthetic outcomes.

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References