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Original Article

A novel design of palatal stent to reduce donor site morbidity in periodontal plastic surgery



Tzu-Shan Chiu ^{a,b†}, Huan-Cheng Chou ^{c†}, Po-Jan Kuo ^d,
Jia-Yuan Liang ^b, Hsien-Chung Chiu ^{d*}

^a Department of Periodontics, National Taiwan University Hospital, Taipei, Taiwan

^b Modern Dental Clinic, Chung-Li, Taoyuan, Taiwan

^c Ten-Chan General Hospital, Chung-Li, Taoyuan, Taiwan

^d Department of Periodontology, School of Dentistry, Tri-Service General Hospital, National Defense Medical Center, Taipei, Taiwan

Received 7 March 2020; Final revision received 20 March 2020

Available online 18 April 2020

KEYWORDS

Donor site;
Connective tissue
graft;
Periodontal plastic
surgery;
Palatal stent

Abstract *Background/ purpose:* The connective tissue graft from hard palate is a reliable graft technique that has been used for achieving root coverage, increasing keratinized tissue width and thickness in periodontal plastic surgeries. Donor site morbidities, including complications from postoperative bleeding, pain during healing phase, difficulties in eating and speaking and unexpecting healing patterns, are always a concern for both doctors and patients. The aim of this study was to investigate a novel design of palatal stent to reduce these complications and provide patient with a smooth healing experience after soft tissue harvesting from hard palate.

Materials and methods: Eight patients requiring connective tissue graft from palatal site were included in the study. The palatal stents made with light-curing hybrid composite resin were fabricated and tried in for patients prior to the periodontal plastic surgeries. Stent was delivered immediately without other dressing material or suture after the graft harvesting procedure for blood clot stabilization. Bleeding tendency was evaluated at the completion of the procedure. Patients came back for follow up in 1 week, 2 weeks and 1 month after the surgery. In the consecutive clinical cases, all patients reported minimal postoperative pain and discomfort (score ranged between 0 and 2). Both chewing and swallowing were not affected when wearing the stent, while four patients reported speaking inconvenience influenced by the stent.

* Corresponding author. Department of Periodontology, School of Dentistry, National Defense Medical Center, P.O. Box 90048-507, Taipei, Taiwan. Fax: +886 2 87927145.

E-mail address: d1121@mail.ndmctsgh.edu.tw (H.-C. Chiu).

† Both authors contributed equally to this study.

Results: In the consecutive clinical cases, all patient reported minimal postoperative pain and discomfort (Score ranged between 0 and 2). Both chewing and swallowing were not affected when wearing the stent while four patients reported speaking influenced by the stent.

Conclusion: The novel design of palatal stent reduces donor site morbidity and provides patient with a good healing experience after soft tissue harvesting from hard palate.

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Introduction

Mucogingival deformities and conditions are common findings in the daily dental practice.¹ Periodontal plastic surgeries address these functional and esthetic demands have become an integral part of the periodontal treatments. Several treatment modalities, including free gingival grafts (FGG), connective tissue grafts (CTG), pedicle grafts, acellular dermal matrix (ADM) grafts and guided tissue regeneration (GTR) have been applied to cover the denuded root surface and to augment the width and thickness of the keratinized tissue.^{2–6} Among all these procedures, CTG along with coronally advanced flap (CAF) is considered gold standard for root coverage procedure.^{7,8}

Autologous CTGs can be harvested from the palate, maxillary tuberosity, or edentulous area, while the palate is the most common donor site. With different harvesting techniques, CTGs compose of different proportion and thickness from lamina propria and submucosa layers from the palate. Subepithelial connective tissue graft (SCTG) harvesting techniques from the palate have been heavily described in the literatures with an intention to leave an adequate thickness of superficial epithelium layer after the harvesting procedure and therefore allow the palatal flap to be repositioned and to heal in primary fashion.^{3,9–12} The primary objective of these SCTG techniques is to reduce postoperative morbidity compare to the techniques that require the removal of epithelium layer with the soft tissue graft.^{13–15} However, SCTG technique should be avoided when palatal fibromucosa thickness is insufficient or when a large size graft is needed for multiple teeth and/or implants.⁶ De-epithelialized gingival graft (DGG), which is extra-orally de-epithelialized by scalpel after harvested as a free gingival graft, described by Zucchelli et al. in 2010 can serve as an ideal substitute for SCTG in these clinical situation.¹⁶

In a histology study on cadavers, DGG comprised lamina propria with greater amounts of fibrous connective tissue, while SCTG was found to be composed of submucosa layer mainly, which contained a large amount of fatty and glandular tissue.¹⁷ Since the epithelial differentiation is determined by the underlying connective tissue, it is not surprising to see DGG has been shown to be a more preferable technique over SCTG in a systematic review for its favorable outcome in achieving mean root coverage, recession reduction, keratinized tissue gain, probing depth reduction and clinical attachment level gain.^{18,19} Despite of the promising outcome, FGG or DGG prevents surgeons and patients from choosing it for its postoperative discomfort.

The surgical wound heals by secondary intention within 2–4 weeks and has been considered associating with postoperative discomfort for the patients due to painful wound and bleeding, which could lead to eating and speaking impairment during the healing course.¹⁴ Even though there are a few evidence showing different opinions on postoperative morbidity when comparing DGG to SCTG, denuded palate from the surgical procedure is always a concern for both dentists and patients.¹⁶ The purpose of the study is to introduce a novel design of palatal stents, which reduce postoperative morbidity and provide patient a comfortable healing phase after FGG or DGG harvest from the palate.

Materials and methods

Patient recruitment

A total of 8 patients (2 males and 6 females; age range, 24–63 years) diagnosed with mucogingival deformities or insufficient keratinized tissue around dental implants participated in this study. Patients with any uncontrolled local or systemic disease where periodontal plastic surgery might be contraindicated and smokers were excluded from the study. All 8 patients were treated in a large private group practice. They were referred by the general dentists for FGG or DGG periodontal plastic surgical treatment. The protocol was approved by the human subjects ethics board of Medicine, Tri-service General Hospital, Taipei, Taiwan and was conducted in accordance with the Helsinki Declaration of 1975, as revised in 2013. Signed informed consent was obtained prior to treatment.

Stent design

Impression of maxillary arch was performed with alginate material to obtain a study model. Light-curing hybrid composite resin (Plaque Photo ®, Willmann & Pein GmbH, Bevern, Germany) was applied to the study model from canine to distal side of the most posterior teeth with the rugae part uncovered so that the phonetics would be minimally affected (Fig. 1). The composite resin material at the posterior palatal area close to the midline was intentionally removed for patient's comfort. Because the retention of the stent came from interdental undercut, the occlusion was not affected. Patients without adequate number of teeth to stabilize the stent were not invited to join the study.

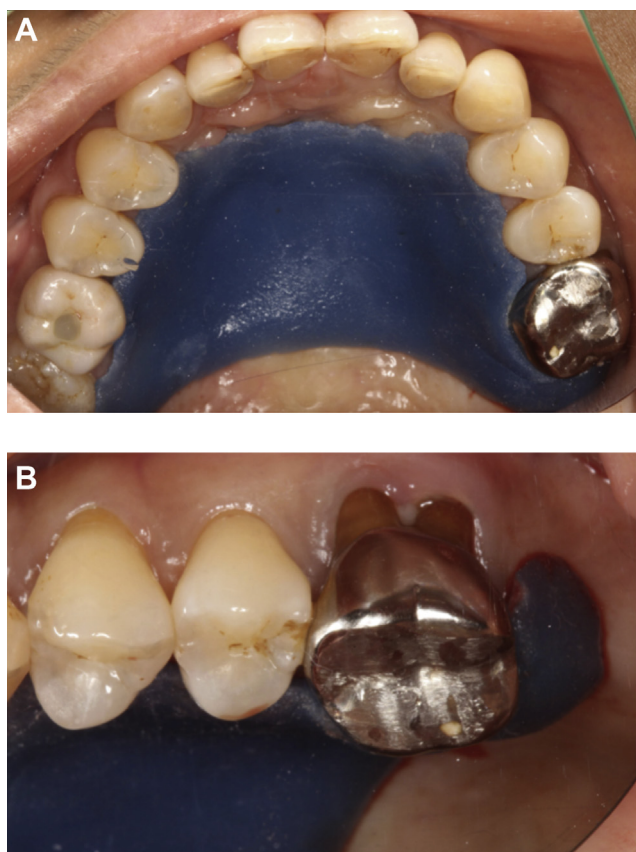


Figure 1 The palatal stent fabricated with light-curing hybrid composite resin. (A) The anterior part of the stent that covered the rugae was hollowed out and the posterior extension was reduced as much as possible. (B) A handle for stent removal was placed at the disto-buccal side of the most posterior teeth.

Surgical procedure

All the patients underwent the same palatal donor tissue harvesting technique performing by two surgeons (T-S Chiu and J-Y Liang). Following the anesthesia of palatal donor site established by local infiltration (2% lidocaine with 1:100,000 epinephrine), the area chosen to harvest the graft was between first premolar and first molar, located at least 3 mm away from the gingival margins depends on the probing depth. A 15C scalpel blade was used to harvest the tissue measuring 1–2 mm in thickness with no difference between patients scheduled for FGG and DGG procedures. The surface area of denuded surface was measured in each patient. For the patients planned for DGG procedure, the epithelium layer of the graft was then removed extraorally with 15C blade.

Clinical application of palatal stent

The palatal stent was tried in one week before the surgery. During the same visit, patients were trained to have the stent taken off from the most disto-buccal side with a special handle design of the stent gently without touching their palate (Fig. 1).

The palatal stent was delivered immediately after the donor tissue harvesting procedure (FGG or DGG) for blood clot stabilization. Bleeding tendency was evaluated at the completion of the whole surgical procedure. The stent was resealed if the bleeding was completely stopped. Topical hemostatic agents (Surgicel, Ethicon, Somerville, NJ, USA), would be applied to the donor site and compressed for additional 30 min with palatal stent if the bleeding persisted.

Postoperative care

Patients were instructed to wear the stent in the first 48 h without removing it. From 48 h to 1 week, patients were allowed to remove the stents carefully only for cleaning purpose. In the second week, stents were only installed during meals to prevent the friction from food to palate while eating. For patients with no known drug allergy, they were prescribed non-steroidal anti-inflammatory analgesics for 5 days and chlorhexidine 0.12% mouth rinse twice daily for 14 days. Patients returned to normal lives and did not wear the appliance after two weeks from the surgery. Pain score of the donor site and discomfort from wearing palatal stent were recorded in 1 week, 2 weeks and 1 month postoperative follow up. Visual analog scale (VAS) was used to assess postoperative pain, with “no pain” as 0 to “worst pain” as 10 in score. Bleeding in the postoperative healing phase and discomfort from wearing palatal stent was evaluated with yes/no verbal questions, including the influence on phonetics, chewing and swallowing.

Results

All 8 patients completed the study by attending the surgery and all follow up appointments. Every patient demonstrated the ability of wearing and removing palatal stent after instruction. Only one patient received topical hemostatic agents combined with palatal stent after surgery. Donor sites hemostasis was successfully achieved in other cases without additional procedure. None of the patients reported bleeding problem during the healing phase.

At one-week follow-up appointment, the surgical wound was filled up by granulation tissue (Fig. 2). All subjects reported minimal postoperative pain from the donor sites. Four patients had 0 for VAS pain score assessment, while three reported 1 and the other reported 2 in a scale of 10. Regarding discomfort from wearing palatal stent, all patients stated that both chewing and swallowing were not affected, while four patients reported speaking inconvenience influenced by the stent. For the patients with their speaking problem, all of them were then used to speak with the stents in position after a few days.

Epithelial migration to cover the wound was noted at two-week follow-up visit (Fig. 3). All patients reported 0 for the pain score in VAS assessment and no interference with wearing palatal stent in the two-week and one-month follow-up. They all showed satisfaction towards the healing of palatal donor sites.

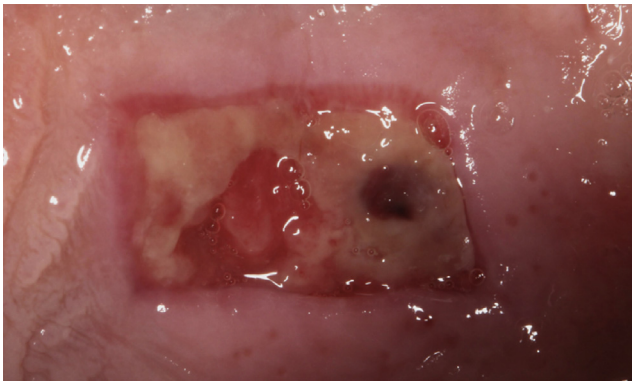


Figure 2 The granulation tissue filled up the palatal donor wound site at one-week follow-up.

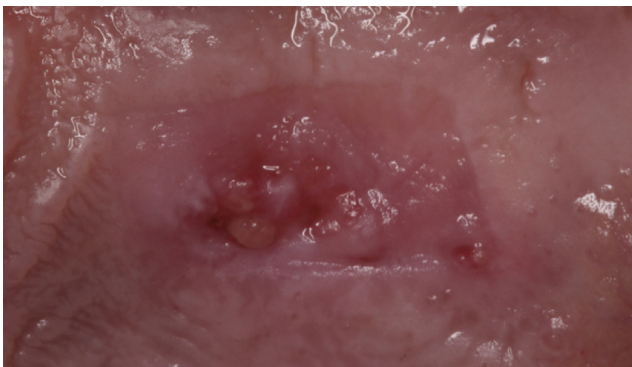


Figure 3 Epithelial migration onto the palatal donor wound at two-week follow-up.

Discussion

The aim of this case series was to provide an innovative design of a palatal stent to alleviate donor site morbidity that has been long addressed in periodontal plastic surgery. Postoperative pain and bleeding are the two most common complications following epithelium layer-included free soft tissue graft harvesting from palatal donor site.^{6,20,21} Considering pain and bleeding are the results of surgical wound healing with secondary intention, different dressing materials and covering methods are introduced in the literatures.^{6,22,23}

Collagen, gelatin sponge and platelet-rich fibrin are commonly used dressing materials to cover wound from FGG or DGG harvesting in the palate.^{6,23} In addition to wound coverage, collagen and gelatin sponge facilitate hemostasis during surgical procedure.^{24,25} However, it requires additional surgical time to secure the materials with sutures and has risk of material lost due to suture loosening, friction from food or patient's tongue movement during eating and speaking. Early loss of material leads to great postoperative pain and possible bleeding from wound raw surface exposure.

The covering methods, including Coe-Pak (GC America, Alsip, IL), Essix retainer with palatal coverage and its modified version, Hawley retainer and its modified version, have been purposed to use for palatal coverage. Except Coe-Pak, all the

covering methods that have been described in the literature are somewhat affecting patients' occlusion, it is therefore not comfortable to wear while eating. In a randomized clinical trial conducted by Eltas et al., in 2014, regardless of the impairment of occlusion, patients were instructed to wear their retainers full-time for 2 weeks. Mean of VAS pain score ranged between 41 and 45/100 with different design of retainers showed better results than Coe-Pak group (67/100).²² However, although it's hard to compare between different researches, pain score is considered much higher than that in our study (mean VAS pain score = 0.5/10). Postoperative bleeding that was reported as 0% in our study was 17% in Eltas'. The design of palatal coverage appliances in Eltas study includes the occlusal surface, which could lead to movement of the retainers on biting. This might be cause additional pain and possible bleeding over the surgical wound on mastication.

With our novel design of palatal stent, we provide retention of the appliance with interdental undercuts to avoid occlusal interference during chewing. In addition to fabricating the stent within 2 mm of thickness to provide enough strength, we bevel the anterior and posterior border for patient's comfort. The saddle-shape design with rugae hollowed for minimizing the interference on speaking and the posterior part extending as minimal as possible to reduce its disturbance on swallowing. Although with half of the patients stated influences on phonetics in the first week follow up, they all got used to speaking with the palatal stent in a few days. Patients were confident with the palatal wound healing for that their appearance and function were both minimally affected.

This study demonstrates that the morbidity of palatal donor site in periodontal plastic surgery can be managed with the novel palatal stent, which provides patient a nearly painless healing experience, protects the palatal wound by covering it, and guides the tissue growth to its original appearance.

Declaration of Competing Interest

The authors have no conflicts of interest relevant to this study.

Acknowledgments

The authors would like to acknowledge the assistance and support provided by from Modern Dental Clinic, Taiwan.

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