Laser De-epithelialization of Autogenous Gingival Graft for Root Coverage and Soft Tissue Augmentation Procedures

Jerry Ching-Yi Lin, DDS, DMSc
Myron Nevins, DDS
David M. Kim, DDS, DMSc

The purpose of this case report was to introduce a novel technique for de-epithelializing autogenous gingival graft that can be combined with coronally advanced flap for root coverage and soft tissue augmentation. This technique allows for easier, predictable harvesting of connective tissue of excellent quality and quantity without inclusion of undesirable submucosa or adipose tissues. Reduced surgical chair time and double protection of the donor site using the combination of cyanoacrylate and periodontal dressing allowed for uneventful postoperative healing. Int J Periodontics Restorative Dent 2018;38:405–411. doi: 10.11607/prd.3587

Mucogingival surgery has been used to improve patients’ gingival health and esthetics by providing keratinized tissue, attached gingiva, and root coverage.1,2 The latest American Academy of Periodontology Regeneration Workshop defined autogenous gingival graft (AGG) and subepithelial connective tissue graft (SCTG) as gold standards for non–root coverage and root coverage procedures.1,2 SCTG combined with coronally advanced flap is the most effective and predictable root coverage procedure for treatment of gingival recession.2

Different SCTG harvesting techniques have been introduced over the years to retrieve an ideal quality and quantity of harvested tissues.3–7 Nonetheless, some problems exist with current SCTG techniques. The ideal quality and quantity of graft may not be determined until after harvesting.8,9 The differing anatomical dimensions of the palate, the presence of thick alveolar process and exostosis, and the location of the greater palatine neurovascular bundle generally limit SCTG harvesting in the area from the mesial line angle of the palatal root of the first molar to the distal line angle of the canine.10 Müller et al11,12 have also hypothesized that the patient’s sex and periodontal phenotype influence the palatal tissue thickness. The quality and quantity of SCTG also depends on the presence

1Lecturer, Part-time, Division of Periodontology, Harvard School of Dental Medicine, Boston, Massachusetts, USA; Assistant Professor, School of Dentistry, Taipei Medical University, Taipei, Taiwan ROC.
2Clinical Associate Professor, Division of Periodontology, Harvard School of Dental Medicine, Boston, Massachusetts, USA.
3Associate Professor, Division of Periodontology, Harvard School of Dental Medicine, Boston, Massachusetts, USA.

Correspondence to: Dr David M. Kim, Harvard School of Dental Medicine, Division of Periodontology, 188 Longwood Avenue, Boston, MA 02115, USA.
Email: dkim@hsdm.harvard.edu

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of glandular and adipose tissue.\textsuperscript{10–13} Harris\textsuperscript{13} conducted a histologic evaluation of SCTGs harvested from patients’ palates and noted that they were not uniform in composition. In some instances the entire graft was composed of lamina propria and contained no submucosa or adipose tissue, while other grafts were primarily composed of adipose tissue.\textsuperscript{13} In addition, currently available SCTG harvesting techniques may not allow for primary healing intention of the donor site, which is dependent on palatal tissue thickness after harvesting or exclusion of epithelial collar with the graft. Thin palatal tissue consisting only of epithelium may undergo dehiscence, necrosis, or sloughing during healing.\textsuperscript{3,8,9} Obtaining a uniform quality of SCTG composed mainly of dense and firm lamina propria with less submucosa/adipose tissue may be difficult with current harvesting techniques.

AGG can be categorized as either partial thickness (consists of epithelium with varying amounts of lamina propria) or full thickness (consists only of lamina propria without submucosa/glandular tissue).\textsuperscript{3} Traditional AGG technique allows for secondary wound healing intention and thus causes greater discomfort and morbidity compared with techniques that use primary intention. Nonetheless, this technique is easy to perform even in the presence of thin palatal tissue. Successful root coverage has been demonstrated using AGG.\textsuperscript{14–17} However, the use of AGG for root coverage is not widely advocated due to differences in color and texture of the grafted site compared to its surrounding tissue.

De-epithelialized gingival graft in combination with coronally advanced flap has been evaluated as an alternative root coverage procedure technique.\textsuperscript{8,9} Zucchelli et al\textsuperscript{8,9} used a 15C blade to remove epithelium from harvested AGG and speculated that this de-epithelialization technique allowed them to obtain dense, firm, and stable connective tissue. De-epithelialization with a scalpel blade can be technique sensitive for an inexperienced clinician, thus the present study proposes a novel way to de-epithelialize AGG using an Er,Cr:YSGG dental laser.

Cases

Case 1 (Root Coverage)

A 19-year-old man presented with multiple gingival recessions on the mandibular right central incisor to first premolar, with 2 to 3 mm of Miller Class I recession (Fig 1a). The tunneling technique was performed to prepare the recipient site with full-split flap elevation. The donor site, from the mesiopalatal side of the maxillary right first premolar to the distopalatal side of the right lateral incisor, was marked with a 15C blade and then de-epithelialized with an Er,Cr:YSGG dental laser (Waterlase iPlus 2, Biolase) (Fig 1b). The MC3 tip was used to de-epithelize the donor site, with laser setting of 2.5W, rapid cut, H mode, 75 pps, 20% air, and 40% water. The laser tip was positioned at 90 degrees against the palatal gingival surface with a light touch. The surface was de-epithelialized three times to completely remove the epithelium. The graft was then removed with the 15C blade and grafted into the gingival tunnel of the recipient site (Figs 1c and 1d). The graft was sling sutured with 5-0 chromic gut sutures, while the flap was sling sutured with 5-0 dPTFE sutures (Fig 1e). The donor site was covered with cyanoacrylate tissue adhesive (PeriAcryl 90, GluStitch) in addition to periodontal dressing (Coe-Pak, GC America) to provide double coverage of the wound site. At his 9-month postoperative visit, the patient demonstrated complete root coverage on the treated teeth (Fig 1f).

Case 2 (Dental Implant Fenestration Coverage)

A 56-year-old woman presented soft tissue fenestration on the buccal aspect of an implant at the site of the maxillary right lateral incisor and crown fracture of the maxillary right central incisor (Fig 2a). The tunneling technique was performed to prepare the recipient site from the maxillary right canine to the right central incisor with full-split flap elevation (Fig 2b). The donor site, from the mesiopalatal side of the maxillary right second premolar to the distopalatal side of the right second molar, was marked with a 15C blade and then de-epithelialized with an Er,Cr:YSGG dental laser at the same setting as in case 1 (Fig 2c). The graft was then removed with the 15C blade and grafted into the gingival tunnel of the recipient site of the lateral incisor from the canine (Fig 2d). The graft was sling sutured with 5-0
chromic gut suture while the flap was
sling sutured with 5-0 dPTFE sutures
(Figs 2e and 2f). The palatal cover-
age technique used for case 1 was
also employed here. The 6-month
postoperative clinical examination
demonstrated complete coverage
of exposed implant threads.

Case 3 (Ridge Augmentation
Using Connective Tissue)

A 29-year-old woman presented
with vertical alveolar ridge deficien-
cy from the maxillary right lateral
incisor to the left lateral incisor (Fig
3a). The envelope technique was
performed to prepare the recipient
site with split-thickness flap eleva-
tion from maxillary canine to canine.
The donor site, from the mesio-
palatal side of the maxillary left first
premolar to the distopalatal side
of the right first premolar and from
the distopalatal side of the maxillary
right first premolar to the distopalatal side of the right first molar, was marked with a 15C blade and then de-epithelialized with Er,Cr:YSGG dental laser at the same setting as in cases 1 and 2 (Fig 3b). The graft was then removed with the 15C blade and grafted onto the crestal side of the edentulous area from lateral incisor to lateral incisor. The graft was sutured with 5-0 chromic gut sutures (periosteal sutures) onto the recipient site, while the flap was sutured with 5-0 dPTFE interrupted sutures (Figs 3c and 3d). The same palatal coverage technique used for cases 1 and 2 was employed. Two dental implants were placed following an uneventful postoperative period (Figs 3e and 3f). A second gingival augmentation was performed to provide keratinized tissue, and a temporary restoration was placed (Figs 3g and 3h).

Fig 2 Case 2. (a) A 56-year-old woman presented with soft tissue fenestration on the buccal aspect of an implant placed at the site of the maxillary right lateral incisor and a crown fracture at the maxillary right central incisor. (b) The tunneling technique was employed to prepare the recipient site. (c) The palatal donor tissue was de-epithelialized with an Er,Cr:YSGG dental laser. (d) De-epithelialized graft was inserted into the defect site and (e) sutured with 5-0 chromic gut sutures. (f) The flap was sutured with 5-0 dPTFE sling sutures. (g) At 6 months postoperative, complete coverage of exposed implant threads was demonstrated.
Discussion

Palatal tissue is composed of dense connective tissue (lamina propria) covered by an orthokeratinized epithelium, and a layer of fatty and glandular tissue (submucosa) of varying thickness is present underneath the lamina propria.\textsuperscript{12,13} Traditional palatal SCTG harvesting technique allows for procurement of limited length and thickness of tissue, influenced by the patient’s palatal anatomical structures. In some cases an adequate connective tissue graft may not be obtainable, and there is a risk of incorporating fatty and glandular tissues that are unsuitable for root coverage.\textsuperscript{8} In rare cases, one may need to harvest connective tissue graft from both sides of the palate to obtain sufficient length and thickness of SCTG.\textsuperscript{10} The remaining palatal flap after graft harvesting should

Fig 3  Case 3. (a) A 29-year-old woman presented with vertical ridge deficiency from the maxillary right lateral incisor to the left lateral incisor. (b) Due to extensive loss of soft tissue volume, two grafts had to be harvested from the right and left sides of the palate. (c) Both grafts were sutured with 5-0 chromic gut. (d) The flap was sutured with 5-0 dPTFE sutures. (e) At 4 months postoperative, adequate vertical gain of soft tissue volume was demonstrated. (f) Two implants were placed. (g) A second de-epithelialized gingival graft was placed to gain keratinized tissue. (h) Clinical photograph taken 1 month after the gingival augmentation.
include both epithelium and connective tissue for viability.\textsuperscript{8}

Zucchelli et al\textsuperscript{8} performed de-epithelialization of the gingival graft after harvesting it from the palate using a 15C blade in a study comparing this technique (test group) to traditional SCTG harvesting technique (control group) in root coverage procedures. The mean thickness of the de-epithelialized gingival graft was $1.32 \pm 0.16$ mm, while the thickness after de-epithelialization and removal of fatty tissue was $0.83 \pm 0.12$ mm.\textsuperscript{8} The advantage of de-epithelialized gingival graft was shortened surgical time, with the difference being statistically significant ($35.8 \pm 3.4$ minutes for de-epithelialized gingival graft versus $45.0 \pm 4.3$ minutes for connective tissue graft surgery). In addition, surgical time was significantly correlated with painkiller consumption. The differences in anesthetic consumption, postoperative discomfort, and bleeding between the two groups were not statistically significant. Most important, no significant difference was demonstrated in the remaining gingival recession depth, clinical attachment level, probing depth, keratinized tissue height, and amount of root coverage between the two procedures 1 year postsurgery ($96.2\%$ in the test group vs $92.2\%$ in the control group). However, complete root coverage was achieved in $84\%$ of the test group and in $72\%$ of control treated defects and in addition denser buccal gingival tissue thickness was observed on the recipient site for the test group. Nonetheless, this de-epithelialization technique, performed extraorally after graft harvesting, requires precision to remove epithelium without removing underlying connective tissue.

Traditional SCTG can be harvested with or without a remaining band of epithelium.\textsuperscript{6} Several investigators have suspected the presence of remnant epithelium in SCTG as the source of cyst, abscess, gingival cul-de-sac development.\textsuperscript{18–22} Harris\textsuperscript{13} performed a histologic evaluation of connective tissue grafts in humans and reported presence of epithelium in 24 out of 30 grafts (80\%) despite attempts to remove it completely from the harvested graft. However, he reported a clinically successful outcome when these grafts with remnant epithelium were used for root coverage procedures. The present laser abrasion technique cannot be relied upon for total de-epithelialization or complete removal of epithelium without performing a biopsy of that area; some epithelium can remain.\textsuperscript{8} A histologic assessment of de-epithelialized palatal gingival graft was conducted, demonstrating complete removal of epithelium using Er,Cr:YSGG laser (Figs 4 and 5). The average thickness of the palatal epithelium in a South Korean population was reported to be $430.63 \pm 104.26$ µm, ranging from 113 to 823 µm.\textsuperscript{22}
The advantage of laser-aided de-epithelialization of AGG is that it is done intraorally, before harvesting, and can be performed uniformly in a controlled manner. Similar to Zucchelli’s graft, one can harvest ideal donor tissue with minimal submucosa/adipose tissue. This technique also allows for reduced surgical chair time because suturing is not needed on the palate with bilayer application of cyanoacrylate and periodontal dressing, which seems to compress the wound site and reduce patient discomfort.

Patient-reported outcome was not assessed in these cases, and a future clinical study should compare patient discomfort level with traditional connective tissue harvesting technique versus laser de-epithelialization of autogenous gingival graft.

Conclusions

These documented cases demonstrate promising clinical outcomes of dental laser de-epithelialized gingival graft for root coverage and soft tissue augmentation procedures.

Acknowledgments

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References