Hinged Forearm Split-Thickness Skin Graft for Radial Artery Fasciocutaneous Flap Donor Site Repair

Kofi Boahene, MD; Jeremy Richmon, MD; Patrick Byrne, MD; Lisa Ishii, MD, MHS

Objective: To present a modified technique in the harvest and application of split-thickness skin graft (STSG) from the primary flap donor site in forearm fasciocutaneous free flaps.

Methods: A prospective review was performed on 16 consecutive patients who had undergone a radial forearm free flap procedure for reconstruction of head and neck defects with a hinged forearm STSG used to reconstruct the flap donor site defect.

Results: Sixteen patients with a mean (SD) defect size of 53.7 (29.9) cm\(^2\) underwent the hinged STSG procedure. A hinged STSG was successfully harvested from all patients without disruption. Graft take was greater than 90% in all patients by postoperative day 7. A secondary skin graft donor site was avoided in all but 2 patients. Good color match of the deepithelialized flap with surrounding oral and pharyngeal mucosa was observed. Visible scarring along the graft hinge margin was absent. No bridging scars resulted from the deepithelialized flaps.

Conclusions: The hinged STSG from the forearm is a reliable method of repairing radial forearm free flap donor site defects and offers the advantages of reduced suture line scarring, minimal STSG disruption, low or no secondary donor site morbidity, and good color match at the donor and recipient flap sites.

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The forearm fasciocutaneous flap based on the radial or ulnar artery is a favored flap in microvascular head and neck reconstruction because of its pliability, its reliability of harvest, and its versatility.1,2 A major disadvantage of this flap, however, is the conspicuous donor site defect that commonly requires repair with a split-thickness skin graft (STSG) harvested from a secondary site.3,4 Split-thickness skin grafts harvested from secondary donor sites can be associated with pain, delayed healing, infection, scarring, and poor aesthetic changes.5,6 To minimize secondary donor site changes, full-thickness skin grafts and pedicled transposition flaps from the proximal aspect of the forearm have been suggested.7,8 The proximal aspect of the forearm is, however, a limited donor site when large forearm defects require closure. To avoid secondary graft sites, artificial dermis also has been used in repairing the radial forearm free flap (RFFF) donor defect.9 An alternative source of skin for resurfacing the RFFF defect is an STSG harvested from the primary forearm donor site.10,11 In this article, we report a technical modification in the harvest and application of STSGs in the repair of forearm donor defects.

METHODS

In 16 consecutive patients who underwent an RFFF for reconstruction of various oral or pharyngeal defects, a hinged forearm STSG was used for donor site repair. Written informed consent was obtained from all patients. These patients were prospectively reviewed for successful skin graft harvest, graft survival, color match, scarring along the hinge line, and luminal scarring.
to 0.018-in thick were harvested with a powered dermatome (Zimmer Holdings, Inc, Warsaw, Indiana). The skin grafts were raised and left-hinged along one of the short or long margins, depending on the flap design (see the video at http://www.archfacial.com). Constant pressure at approximately a 45° angle to the skin surface was exerted on the dermatome throughout the harvest. The dermatome blade was deactivated at the hinge line to prevent inadvertent injury to the graft attachment. The elevated STSGs were covered with moist gauze and kept hydrated until they were ready to be applied. Then, the RFFs were harvested in a subfascial plane in a routine manner, changing to a suprafascial level over the tendons. The donor site defects were repaired by replacing the hinged STSGs. The STSGs were not meshed in any of the cases. The STSGs were immobilized for 5 to 7 days with a continuous vacuum-assisted suction device (Figure 1). Graft viability was visually assessed on postoperative days 5 to 7 after the retention bolsters were removed. Herein, successful harvest of a hinged STSG is defined as the ability to raise the STSG without disruption, keeping it pedicled to the adjacent skin. The viability of the skin graft on the forearm was determined on postoperative day 7. Graft viability was recorded by the principal author (K.B.) after visual inspection as a percentage of the defect covered by viable skin without exposure of the underlying defect.

RESULTS

In all 16 patients, a hinged STSG was successfully harvested from the forearm. The mean (SD) defect size was 53.7 (29.9) cm². Complete repair of the forearm defect was achieved in 14 of 16 patients (88%) using only the hinged STSG. In 2 patients whose initially designed RFFs were enlarged after the hinged STSG had been harvested, an additional 2-cm strip of STSG was harvested from the thigh to allow complete closure of the forearm defect. We observed 90% or greater graft survival in all cases at the seventh postoperative day. One patient had an exposed tendon that healed secondarily from conservative measures. Assessment of the forearm donor site between 1 and 3 months after the primary surgical procedure showed complete defect coverage, acceptable color match, and no scarring along the graft hinge line (Figure 2). For the oral defects, the partly deepithelialized RFFs completely reepithelialized with excellent mucosal and flap color match (Figure 2). In 1 African American patient, punctuate areas of hyperpigmentation within a mostly pink-looking neo-
tongue were observed. No flap loss and no luminal scarring in tubed pharyngoesophageal flaps were observed.

**COMMENT**

We have presented a technical modification in the harvest and application of STSGs harvested from the primary donor sites of fasciocutaneous flaps for the repair of resulting donor site defects. In all previous descriptions of STSG harvest from the forearm flap donor sites, the grafts were detached completely. We have found that leaving the harvested STSG pedicled keeps the graft properly oriented; minimizes initial graft curling, contraction, and disruption; and spares additional scarring along the hinge site. The graft survival with this modified hinge technique is greater than 90% and is associated with few complications.

Although attached to adjacent skin that is perfused, a hinged STSG of thin to intermediate thickness (0.001-0.018 in) is not a vascularized flap and depends on early imbibition and neovascularization for graft survival. Therefore, a supportive tissue bed, particularly over the flexor tendons, is necessary for graft viability. Suprafascial dissection over the tendons and overwhelming of the flexor tendon with the long flexor muscle of the thumb and the superficial flexor muscle of the fingers has been reported to improve STSG healing. Raising a thick-hinged STSG on the forearm leaves a thin dermal layer on a mostly fascial flap and may preserve the subcutaneous vascular network, which reliably supplies the forearm skin by means of numerous longitudinal and transverse anastomoses.

The technique used in harvesting skin from the forearm is similar to that generally used in other donor sites. The forearm is, however, convex and may not allow proper contact with the dermatome blade. Often, a dermatome blade guard slightly wider than the width of the planned flap is necessary because the outer edges of the blade do not make good skin contact. Harvesting STSGs from a planned fasciocutaneous flap donor site has been described previously for the forearm and fibula flap donor sites. The major advantage of this approach is the avoidance of a secondary donor defect that heals by reepithelialization. An additional benefit is the color match at the forearm and the flap recipient site. Early monitoring of partially deepithelialized fasciocutaneous flaps may be challenging. Punctate bleeding from the disrupted papillary vessels occurs. Soon, this early bleeding is replaced by the appearance of a fibrinous layer, which may make it difficult to assess the flap by color. Rubbing the flap with hydrogen peroxide restarts the punctate bleeding. Other flap monitoring measures, such as direct Doppler imaging of vessels on the skin paddle, flap warmth, use of implanted Doppler imaging, and surface flap oximeter, are helpful.

The thickness of the forearm skin has been reported to remain relatively constant until the seventh decade of life, after which time it diminishes. Therefore, although STSGs as thick as 0.018 in may be harvested safely from the forearm in most patients, thinner skin grafts should be considered in patients 70 years and older. The exposed dermis in adjacent deepithelialized skin flaps are at risk of scarring together. In tubed pharyngoesophageal flaps will impair swallowing. Thus, caution should be exercised in the design and application of deepithelialized flaps in tubed reconstructions. Two patients in this series who had tubed pharyngoesophageal reconstructions have had clear swallow evaluations and continue to tolerate oral intake without evidence of luminal narrowing.

The hinged STSG harvested from the forearm is a reliable method of repairing RFFF donor site defects and offers the advantages of reduced suture line scarring, minimized STSG disruption, no secondary donor site morbidity, and good color match at the donor and recipient flap sites.

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**Correspondence:** Kofi Boahene, MD, Department of Otolaryngology–Head and Neck Surgery, Johns Hopkins University School of Medicine, 601 N Caroline St, Sixth Floor, Johns Hopkins Outpatient Center, Baltimore, MD 21287 (dboahen1@jhmi.edu).

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**Online-Only Material:** A video is available at http://www.archfacial.com.

**REFERENCES**