Saved by De-epithelialization: DIEP Flap Dermal Skin Regeneration Salvage after Mastectomy Skin Flap Loss

Mansher Singh, MD
Matthew Carty, MD
Kristo Nuutila, PhD
Joseph A. Ricci, MD
Edward J. Caterson, MD, PhD
Stephanie A. Caterson, MD

**Background:** Wound re-epithelialization has been traditionally described to occur from the dermal appendages of the wound edges. As such, the role of the dermal wound bed in re-epithelialization has been questioned. In a patient undergoing breast reconstruction with free tissue transfer, the buried portions of the free flap skin paddle could be either de-epithelialized or deskinned. In case of mastectomy skin flap loss, the role of de-epithelialized skin in wound healing has not been described before.

**Methods:** We report a patient with bilateral mastectomies and bilateral deep inferior epigastric perforator flaps whose postoperative course was complicated by bilateral full-thickness mastectomy skin flap loss. Multiple debridements of nonviable skin resulted in exposure of previously buried de-epithelialized skin paddle of the deep inferior epigastric perforator flap.

**Results:** Our study demonstrates self re-epithelialization of the dermal wound bed from the dermal appendages. We noticed multiple noncontiguous neoeipidermal islands in the dermal wound bed, which did not communicate with the wound edges.

**Conclusions:** In case of full-thickness mastectomy skin flap loss, deep vascular plexus present in the dermal bed of the underlying de-epithelialized skin paddle of the free flap converts an otherwise full-thickness wound to a partial-thickness wound. Our study demonstrates the self-epithelialization potential of the de-epithelialized dermal wound bed from the dermal appendages when exposed to air and in the presence of wound healing elements. (Plast Reconstr Surg Glob Open 2015;3:e511; doi: 10.1097/GOX.0000000000000466; Published online 10 September 2015.)

Re-epithelialization is an essential part of wound healing because it helps in reestablishing the barrier function of the skin.\(^1\,^2\) The traditional dogma regarding wound re-epithelialization involves skin appendages from the epidermis of wound edges.\(^2\,^3\) As such, the re-epithelialization ability of the dermis has been questioned. There have been few studies demonstrating successful re-epithelialization of wound with dermal grafts.\(^4\,^5\) However, the role of dermis in neoeipithelialization could not be established in these studies.

We report a patient who underwent bilateral mastectomies and deep inferior epigastric perforator (DIEP) flap reconstruction. Her postoperative course was complicated by bilateral full-thickness mastectomy skin flap loss. Multiple debridements of viable skin resulted in exposure of previously buried de-epithelialized skin paddle of the DIEP flap. Our study demonstrates self re-epithelialization of the dermal wound bed from the dermal appendages.

**Disclosure:** The authors have no financial interest to declare in relation to the content of this article. The Article Processing Charge was paid for by the authors.
INDEX PATIENT

Our patient, a 48-year-old woman, was initially diagnosed with left breast ductal carcinoma in-situ and underwent lumpectomy and radiation of her left breast. On follow-up imaging and biopsy, she was found to have invasive ductal carcinoma of the left breast for which she underwent neoadjuvant chemotheraphy followed by left breast skin-sparing mastectomy and prophylactic right mastectomy. Immediate bilateral breast reconstruction was performed with DIEP flaps. All buried portions of the DIEP flap skin paddle were de-epithelialized and redundant mastectomy skin was excised. The patient had an uneventful recovery and was discharged on postoperative day 5. However, she returned to the clinic on postoperative day 8 with concerns of acute breast infection and skin in the left breast reconstruction area (Fig. 1). She reported purulent fluid drainage through a prior incision on the left chest wall and developed similar picture in the reconstructed right breast over the course of the next few days. She was hospitalized, started on intravenous vancomycin and clindamycin, and serial debridements of necrotic/infected mastectomy skin were begun. Although the skin paddles of the DIEP flaps were viable, the mastectomy skin flaps in the inferomedial and superolateral areas were compromised bilaterally. The mastectomy skin was debrided back until the healthy-appearing skin was evident at all the skin margins, requiring multiple operative procedures. This resulted in exposure of the de-epithelialized skin paddle of the DIEP flap (Fig. 2). Based on intraoperative culture data, the patient was switched to oral Bactrim and was discharged with a vacuum-assisted closure device. On 2-week follow-up, she was found to have multiple isolated islands of epithelialization on her exposed de-epithelialized dermal skin paddle, which were not confluent with the wound edges (Fig. 2). Wound care was switched to Aquacel Ag and her antibiotics were discontinued. During subsequent clinical visits, she continued to have more coalescing islands of epithelializations with about 50% of wound coverage in 5 weeks and almost complete epithelialization of the wound by 7 weeks (Fig. 3). Over the course of the next 2 months, the epithelialization of the exposed dermis was complete and the wound was almost indistinguishable from the surrounding area. Subsequently, she underwent a small revision of the right breast reconstruction scar and tattooing.

Fig. 1. Concern for acute infection and mastectomy skin flap necrosis in the patient with bilateral mastectomies and immediate DIEP flap reconstruction.

Fig. 2. Debrided bilateral wounds with exposed dermal wound bed of the DIEP flaps.

Fig. 3. Multiple isolated skin islands that are noncommunicating with the wound edges.
of her nipple–areolar complex. Ultimately, the neo-epidermis matched the surrounding skin color well (Fig. 4).

**DISCUSSION**

Mastectomy skin flap necrosis is a common complication following mastectomy, occurring in almost 20% cases. In a patient undergoing breast reconstruction with free tissue transfer, the buried portions of the free flap skin paddle could be either de-epithelialized or deskinned. In the case of full-thickness mastectomy skin flap loss, the deep vascular plexus present in the dermal bed of the underlying de-epithelialized skin paddle of the free flap converts an otherwise full-thickness wound to a partial-thickness wound. This potentially promotes minimal wound contraction, which helps to maintain the desired breast. Also, the vascular dermal bed provides for a healthy platform for skin grafting, if needed. However, de-epithelializing a large skin paddle can be time consuming during the initial operation. In addition, the thicker de-epithelialized skin paddle may be palpable later compared with the softer, nonpalpable flap edges of a deskinned skin paddle.

In wounds healing with secondary intention, the epithelialization is believed to start from the skin appendages from the wound edges and gradually covers the entire wound as an advancing sheet. However, in our patient, there were distinct noncontiguous multiple skin islands on a dermal wound bed, which were discontinuous with the wound edges.

**CONCLUSIONS**

Buried de-epithelialized skin is commonplace in breast reduction surgery and autologous breast reconstruction. This buried skin does not re-epithelialize. This may be due to suppression of the dermal appendages when covered with an overlying tissue. It is possible that without contact inhibition these wound healing elements can be reactivated through an undiscovered mechanism to promote self re-epithelialization. Further study is ongoing to understand this clinical phenomenon.

**REFERENCES**

1. Singer AJ, Clark RA. Cutaneous wound healing. *N Engl J Med*. 1999;341:738–746.
2. Martin P. Wound healing—aiming for perfect skin regeneration. *Science*. 1997;276:75–81.
3. Escámez MJ, García M, Larcher F, et al. An in vivo model of wound healing in genetically modified skin-humanized mice. *J Invest Dermatol*. 2004;123:1182–1191.
4. Tanabe HY, Aoyagi A, Tai Y, et al. Reconstruction for palmar skin defects of the digits and hand using plantar dermal grafting. *Plast Reconstr Surg*. 1998;101:992–998.
5. Yeow VK. Cleft lip scar camouflage using dermal micro-grafts. *Plast Reconstr Surg*. 1999;103:1250–1253.
6. Reed GF, Zafra E, Ghyselen AL, et al. Self-epithelization of dermal grafts. *Arch Otolaryngol*. 1968;77:518–521.
7. Kroll SS. The early management of flap necrosis in breast reconstruction. *Plast Reconstr Surg*. 1991;87:993–999.
8. Iwuagwu OC, Drew PJ. De-skimming versus deep epithelialization for inferior pedicle reduction mammoplasty: a prospective comparative analysis. *Aesthetic Plast Surg*. 2005;29:202–204.
9. Hidalgo DA. Improving safety and aesthetic results in inverted T scar breast reduction. *Plast Reconstr Surg*. 1999;103:874–886; discussion 887.
10. Rubis BA, Danikas D, Neumeister M, et al. The use of split-thickness dermal grafts to resurface full thickness skin defects. *Burns* 2002;28:752–759.