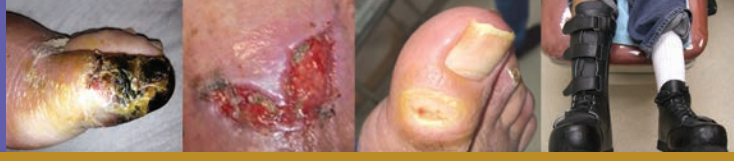

Epidermal Grafting using the CELLUTOME™

This harvesting system can be used in clinical practice.

BY ANIMESH BHATIA, DPM

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Introduction

Chronic wounds occur when the normal healing process stalls or fails. This can be due to a number of factors including patient age, co-morbid conditions (i.e., obesity, diabetes, tobacco use, nutrition), medication use, and the wound environment (infection, moisture levels, impaired perfusion).[1,2] Patients and wounds can be optimized for healing through active management of co-morbid conditions to help reduce wound healing barriers.[3] Additionally, wound bed preparation can promote healing by removing debris and devitalized tissue, managing bioburden, and creating a moist wound environment conducive to granulation tissue development.[4]

However, despite the patient and wound optimization, some chronic wounds may require the use of skin grafting. Scientific advancements in wound care have expanded skin grafting options to include the use of epidermal grafts to promote wound closure. This article will discuss the use of epidermal grafting in wound care, representative case studies, and the coding and reimbursement guidelines for the use of an epidermal harvesting system.

History of Epidermal Grafting

Kiistala and Mustakallio first reported harvesting of the epidermal skin layer for skin grafting in 1964.[5] Prior to this, skin grafts contained portions of the dermal layer, commonly referred to as full-thickness or split-thickness skin grafts. In 1971, Falabella used epidermal grafting to treat vitiligo lesions with moderate repigmentation success.[6] By 1975, epidermal grafting was reported in

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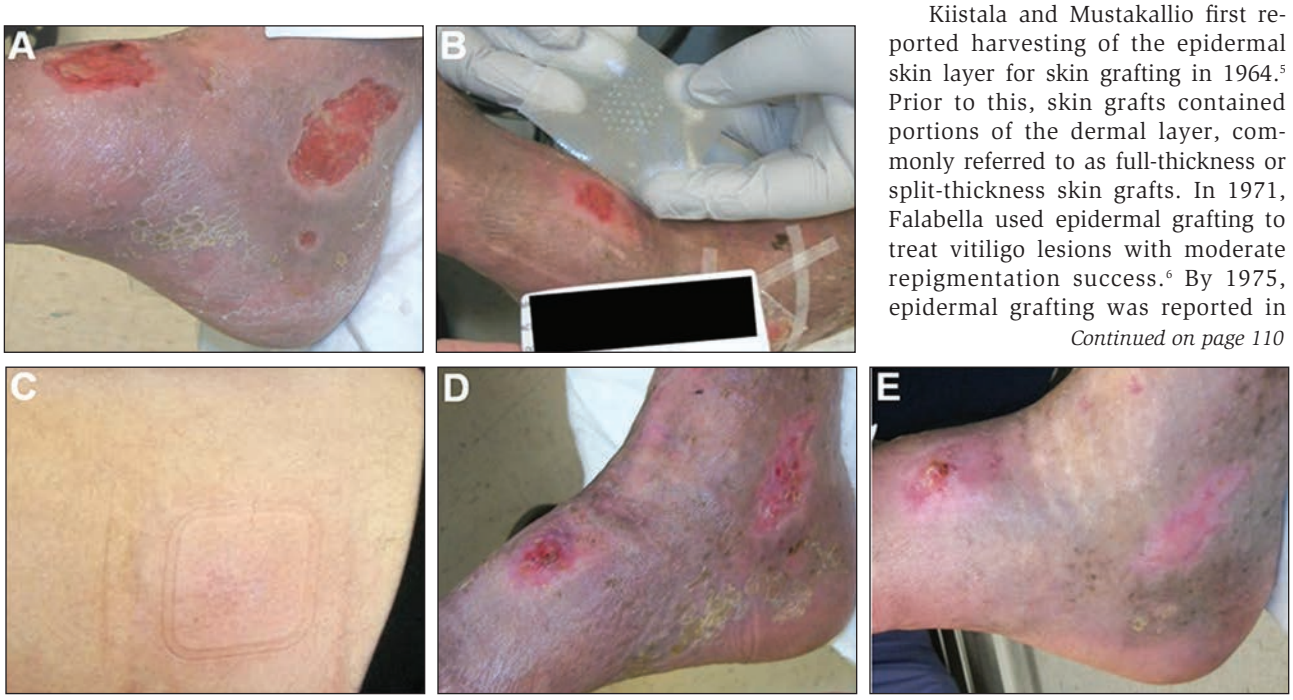
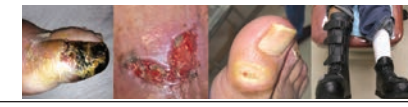


Figure 1. Epidermal grafting of right dorsal foot venous stasis ulcer. Wound at presentation (A), application of epidermal microdomes (B), donor site immediately following epidermal harvesting (C), wound at two weeks post-grafting (D), and wound fully closed at 12 weeks post-grafting (E).



Epidermal Grafting *(from page 109)*

leg ulcers where 10 out of 12 patients showed 100% re-epithelialization within 14 days[7], and its use was expanded in 1981 to include burn patients.[8] Here, epidermal grafts were harvested, cultured, and grafted onto the burn wounds of two patients.

Results showed good graft take and confluence with the surrounding meshed split-thickness grafts or undamaged epidermis. Early attempts to harvest the epidermal skin layer included needles to raise the skin, followed by removal using a scalpel or surgical knife.[9] Various suction devices were then designed in an effort to improve the ability to raise and separate the epidermal skin layer and included suction pumps, vacuum bottles, hoses, and plastic suction cups.[6,10,11]

In 1999, a negative pressure cutaneous suction chamber system was used to raise epidermal grafts. This device provided negative pressure along with warmth to raise grafts.[12] However, this device was only capable of raising four epidermal grafts. More recently, a commercially available epidermal graft harvesting system (CELLUTOME™ Epidermal Harvesting System, KCI, an ACELITY Company, San Antonio, TX) was created to deliver negative pressure and warmth to reproducibly raise and harvest epidermal micrografts (referred to a microdomes).

Brief Review of the Literature

A number of recent studies describing use of epidermal microdomes harvested with the epidermal graft harvesting system have been published. Overall, these studies have reported wound closure in a majority of patients, and donor site healing without complications in all patients.[13–20] Additionally, while only three studies report on pain, all reported minimal to no pain at the donor site during or after graft harvesting.[18,20]

Clinical Advantages

Traditional skin grafting utilizes full or split-thickness skin grafts and creates a wound at the donor site. Both the recipient and donor sites can develop complications such as graft contraction, scarring, infection, and pain, which can increase patient morbidity following the grafting procedure.

Traditional skin grafting utilizes full- or split-thickness skin grafts and creates a wound at the donor site.

Epidermal grafting is an alternative to traditional skin grafting that uses a minimal amount of a donor site's epidermal skin layer. Unlike full or split-thickness skin grafting, epidermal grafting can be performed without anesthesia in the outpatient or physician office setting. Minimal to no pain has been reported during the harvesting procedure.[18,20,21]

Additionally, donor sites have been reported to heal with minimal to no donor site complications within four weeks of epidermal graft harvesting.[14,15]

Practical Use of Epidermal Grafting in Wound Care

In my practice, especially in cases of stalled wounds, I use epidermal grafting as part of the standard treatment protocol. Typically, I use epidermal grafting in a number of wound types including diabetic foot ulcers, venous ulcers, pressure ulcers, traumatic wounds, and surgical dehiscence.

Clinical Application of Epidermal Grafting

Patient Exam

Upon presentation to the clinic, all patients undergo a thorough exam that can include a vascular work-up, nutrition consult, blood work, and imaging (such as diagnostic ultrasound or x-ray). The patient exam helps identify co-morbidities that may interfere with wound healing. If possible, a treatment plan to help manage patient co-morbidities is enacted, with appropriate referrals.

Wound Bed Preparation

In order to minimize the risk of graft failure, a treatment plan to promote the development of granulation tissue and maintain a moist wound environment is created. Following the initial patient and wound exam, non-viable tissue is removed from the wound through debridement. If the wound shows signs of infection, infection management practices are initiated. Off-loading and compression therapy can also be used to assist with protection of the wound.

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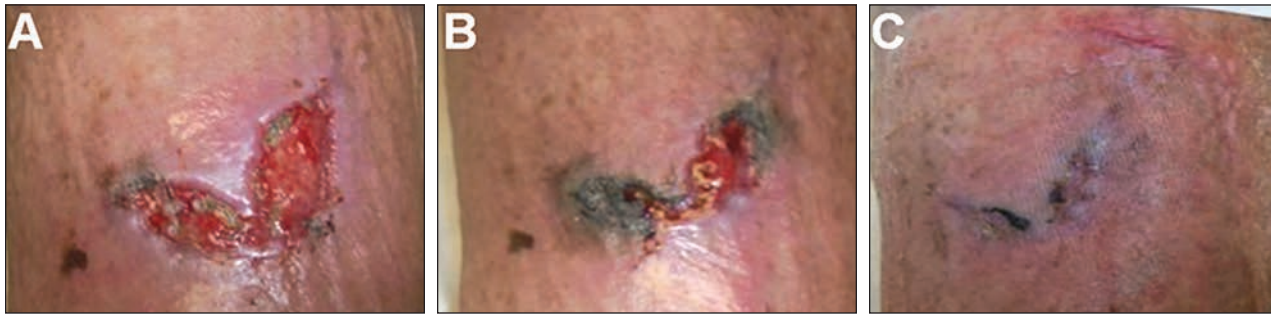
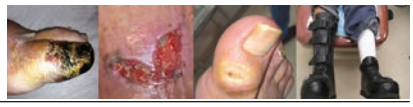


Figure 2. Epidermal grafting of a traumatic left ankle wound. Wound after one week of silver nitrate (A), wound on day of epidermal grafting (B), and wound fully closed at two weeks post-grafting (C).



Epidermal Grafting *(from page 110)*

Epidermal Grafting Procedure

Once the wound bed is 100% covered by healthy granulation tissue, epidermal grafting can occur. A 10cm x 10cm donor site area (typically the inner thigh) is selected, and any hair is removed. The donor site is then washed with 70% isopropyl alcohol and left to air dry. The harvester is placed on the donor site and secured to ensure that complete contact is made with the skin. The vacuum head is attached to the harvester, and warmth and negative pressure are applied to raise the epidermal microdomes. Depending on skin thickness at the donor site, epidermal microdomes are usually raised within 30 to 45 minutes.

After the microdomes have formed, the epidermal harvesting system unit's power is turned off and the vacuum head removed. A non-adherent silicone dressing (ADAPTIC TOUCH™ Non-Adhering Silicone Dressing, Systagenix, an ACELITY Company, Gargrave, UK) is gently placed over the raised epidermal microdomes and harvested. The microdomes are immediately transferred to the wound, followed by coverage with a secondary dressing. A self-adherent wrap or negative pressure wound therapy can be used as a bolster over the dressing to secure the microdomes to the wound bed. The harvesting system is removed from the donor site and a transparent film dressing (TEGADERM™ Transparent Film Dressing, 3M™, St. Paul, MN) is placed over the donor site.

The non-adherent silicon dressing remains in place for one week following graft transfer, which ensures that the microdomes remain undisturbed in the wound bed. The bolster and donor site dressings are changed once a week according to the manufacturer's instructions. The wound and the donor site are monitored weekly for signs of wound healing.

Case Series

Representative case studies of epidermal grafting in my practice are described below.

Case 1

A 63-year-old male presented to the clinic with a venous stasis ulcer on the right dorsal foot present for >6 weeks (Figure 1A). The wound showed edema, scant seropurulent exudate, and 26–50% loose slough. Medical history included diabetes, hypertension, chronic obstructive pulmonary disease, peripheral vascular disease, and coronary artery disease. Previous treatments included off-loading, non-adherent dressings, porcine small intestinal submucosa matrix, dermal repair scaffold, and cryopreserved placental membrane. The wound underwent sharp debridement eight times prior to epidermal grafting. Epidermal microdomes were harvested from the right thigh (Figure 1B), placed over the wounds, and covered with a foam dressing and gauze as a bolster (Figure 1C). Re-epithelialization of the wounds was observed two weeks post-grafting (Figure 1D). Twelve weeks post-grafting, the wounds were fully closed with no complications (Figure 1E). The donor site healed within two weeks without complications.

Case 2

A 68-year-old male presented with a traumatic injury to the left ankle. Edema, 10% adherent yellow slough, and hypergranulation of the wound were noted. Patient medical history included diabetes, hypertension, deep vein thrombosis, gastroesophageal reflux disease, osteoarthritis, atrial fibrillation, hyperlipidemia, and an enlarged prostate. Silver nitrate was applied to the wound in order to reduce hypergranulation, followed by off-loading with an Unna boot (Figure 2A). After two weeks of this treatment, the wound underwent epidermal grafting (Figure 2B). Epidermal microdomes were harvested from the left thigh, applied to the wound, and bolstered with gauze and self-adherent wrap. Two weeks post-grafting, the wound was fully healed without complications (Figure 2C). The donor site healed within two weeks without complications.

Once the wound bed is 100% covered by healthy granulation tissue, epidermal grafting can occur.

Case 3

An 81-year-old female presented with a traumatic injury to the right

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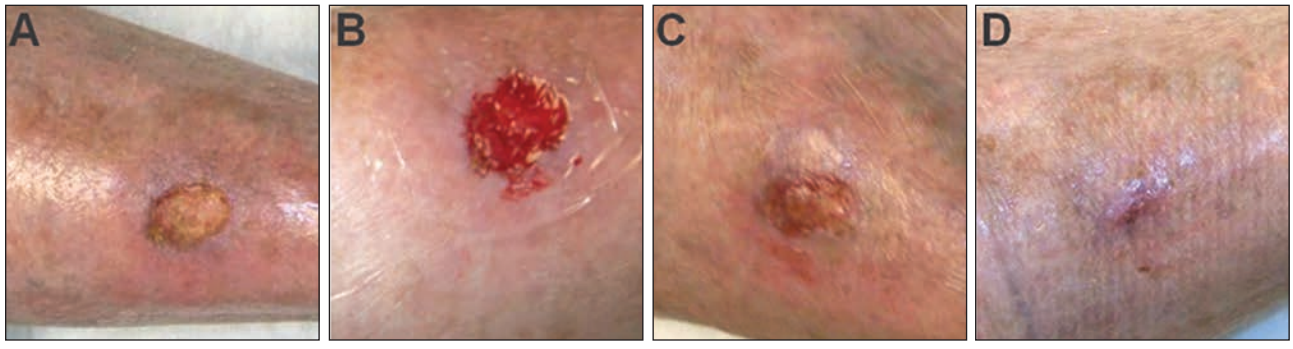
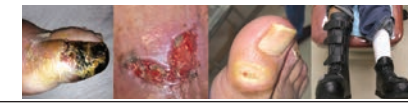


Figure 3. Epidermal grafting of a traumatic right shin wound. Wound at presentation (A), application of epidermal microdomes (B), wound at two weeks post-grafting (C), and wound fully healed at six weeks post-grafting (D).



Epidermal Grafting *(from page 111)*

shin present for 5 weeks (Figure 3A). Previous medical history included obesity, cancer, gastroesophageal reflux disease, glaucoma, and osteoporosis. Collagenase ointment and wet/dry dressings were applied to the wound daily. Three weeks later, epidermal grafting was performed with microdomes harvested from the left thigh and bolstered with gauze and a self-adherent wrap (Figure 3B). Wound re-epithelialization was observed two weeks post-grafting (Figure 3C). At six weeks post-grafting, the wound was completely healed without complications (Figure 3D). The donor site healed within two weeks without complications.

Coding and Reimbursement for Use of the Epidermal Harvesting System

Coding and reimbursement guidelines vary depending on the requirements of the payor. Before filing any claims, providers should verify requirements and policies with the payor as well as any pre-authorization steps. Cost and reimbursement numbers are approximate and may vary by carrier and state. Each payor may have differing formal or informal coding and coverage policies or decisions.

Coding of Wound Bed Preparation

Prior to epidermal grafting,

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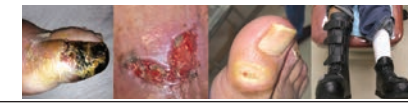
TABLE 1:

Codes for Wound Bed Preparation

Code	Description	Body Part Affected	Use
15002	Surgical preparation or creation of recipient site by excision of open wounds, burn eschar, or scar (including subcutaneous tissues), or incisional release of scar contracture.	• Trunk • Arms • Legs	• First 100 square cm • 1% body area of infants and children
15003	Surgical preparation or creation of recipient site by excision of open wounds, burn eschar, or scar (including subcutaneous tissues), or incisional release of scar contracture.	• Trunk • Arms • Legs	• Each additional 100 square cm • Each additional 1% body area of infants and children • List separately in addition to 15002
15004	Surgical preparation or creation of recipient site by excision of open wounds, burn eschar, or scar (including subcutaneous tissues), or incisional release of scar contracture.	• Face • Scalp • Eyelids • Mouth • Neck • Ears • Orbits • Genitalia • Hands • Feet • Multiple digits	• First 100 square cm • 1% body area of infants and children
15005	Surgical preparation or creation of recipient site by excision of open wounds, burn eschar, or scar (including subcutaneous tissues), or incisional release of scar contracture.	• Face • Scalp • Eyelids • Mouth • Neck • Ears • Orbits • Genitalia • Hands • Feet • Multiple digits	• Each additional 100 square cm • Each additional 1% body area of infants and children • List separately in addition to 15002

Codes and descriptions obtained from current procedural terminology.[22]

Table 1. Codes for wound bed preparation



Epidermal Grafting *(from page 112)*

wound bed preparation is required. There are several different codes (CPT 15002–15005) that can be used for this procedure (Table 1).[22] In order to receive reimbursement for the wound bed preparation that encompasses an area larger than 100 square centimeters or 1% body area (infants and children only), it is important to list each additional 100 square centimeters or 1% body area separately along with the primary code (CPT 15002 or 15004).[22]

Coding for Epidermal Grafting

For epidermal grafting, coding rules are similar to those of wound bed preparation (Table 2).[22] Each additional 100 square centimeters or 1% body area (infants and children only) of grafting should be listed separately after the code for the primary procedure.[22] A coding modifier of 58, indicating a staged or related procedure or service by the same physician during the post-operative period, could be used when submitting the codes if the intent is to possibly repeat the procedure during the global period, and this must be noted in the documentation. The global period is 90 days for the physician, or if the epidermal grafting is performed in a wound center, there is no global period for the wound center itself.

When documenting the epidermal grafting procedure, all notes from the initial visit, including the day of the epidermal grafting procedure, it is important to report the type of wound as well as wound location, size, and depth, and presence of drainage and/or necrotic tissue. If debridement is performed, the method and depth of debridement (pre and post-measure-

Continued on page 115

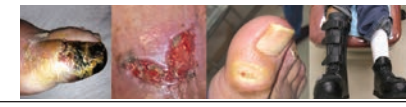
TABLE 2:

Codes for Epidermal Grafting

Code	Description	Body Part Affected	Use
15110	Epidermal autograft	• Trunk • Arms • Legs	• First 100 square cm • 1% body area of infants and children
15111	Epidermal autograft	• Trunk • Arms • Legs	• Each additional 100 square cm • Each additional 1% body area of infants and children, or part thereof • List separately in addition to 15110
15115	Epidermal autograft	• Face • Scalp • Eyelids • Mouth • Neck • Ears • Orbits • Genitalia • Hands • Feet • Multiple digits	• First 100 square cm • 1% body area of infants and children
15116	Epidermal autograft	• Face • Scalp • Eyelids • Mouth • Neck • Ears • Orbits • Genitalia • Hands • Feet • Multiple digits	• Each additional 100 square cm • Each additional 1% body area of infants and children, or part thereof • List separately in addition to 15115

Codes and descriptions obtained from current procedural terminology.[22]

Table 2. Codes for epidermal grafting



Epidermal Grafting *(from page 114)*

ments and partial, full-thickness, etc.) must be documented. The treatment plan should be documented as well as any dressings applied in the office. However, the use and application of dressings used for the procedure should not be billed.

Epidermal grafting is an alternative to traditional skin grafting for chronic or stalled wounds requiring only the epidermal layer.

Reimbursement

Reimbursement costs vary depending on the type of facility.[23-25] A list of the common reimbursement figures are provided in Table 3. It is important to remember that several payor variations exist. For example, commercial carriers require pre-authorization, and Medicare has no local coverage determinations for epidermal grafting.

Economic Benefits

To date, there is no published literature on the cost- effectiveness of epidermal grafting compared with split-thickness skin grafting. However, in adult patients, epidermal grafting can be performed in the office or at the bedside without the need for anesthesia, surgeon, or operating room, which may reduce the cost of the procedure over traditional grafting options.

Conclusion

Epidermal grafting is an alternative to traditional skin grafting for chronic or stalled wounds requiring only the epidermal layer. My practice utilizes epidermal grafting as part of the standard of care. This protocol includes meticulous attention to debridement, off-loading, compression, management of infection, vascular compromise, co-morbidities, and nutrition through appropriate referrals. We use dressings, cellular and tissue-based products, and negative pressure to advance the wound bed to healthy granulation, and finally provide re-epithelialization with epidermal grafting. This method has provided positive clinical results. Further studies are necessary to determine the clinical and cost-effectiveness of epidermal grafting compared to split-thickness skin grafts in chronic wounds.

Acknowledgements

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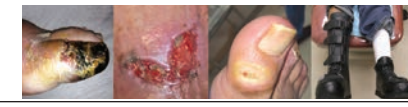
TABLE 3:

Reimbursements for Epidermal Grafting by Type of Facility

Facility Type	Code 15110	Code 15111	Code 15115	Code 15116
Physician (office)	$821.17	$119.31	$844.81	$157.64
Physician (wound care center/ambulatory surgical center)	$717.27	$107.84	$739.12	$142.59
Hospital (outpatient department) or wound care center	$1,411.21	Included	$1,411.21	Included
Ambulatory Surgical Center	$789.12	Included	$789.12	Included

Reimbursement amounts obtained from Centers for Medicare and Medicaid Services.[23-25]

Table 3. Reimbursements for epidermal grafting by type of facility



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