

# Complex Scalp Reconstruction with Super Thin DIEP Free Flap

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**Summary:** Scalp reconstruction provides a unique challenge to the reconstructive surgeon, especially in terms of matching skin color and contour. We present a case of a 67-year-old man with a chronic scalp wound requiring soft tissue coverage after major debridement and coverage of a skull defect. We chose to use a super thin deep inferior epigastric perforator (DIEP) flap to provide good skin coverage along with good contour to the scalp. The use of a super thin DIEP flap, dissected above the superficial fascial plane, is a newer technique in the realm of free tissue transfers that has shown improved outcomes in wound contour. Although the DIEP flap has been popularized for breast reconstruction, the authors believe that it has the ability to provide good soft tissue and skin coverage to other areas of the body, including in head and neck reconstruction. (*Plast Reconstr Surg Glob Open* 2024; 12:e5891; doi: 10.1097/GOX.0000000000005891; Published online 7 June 2024.)

Scalp reconstruction may be required for a multitude of reasons, but can be challenging in terms of cosmesis and obtaining adequate coverage. Reconstructive scalp procedures include primary closure, skin grafting, local flap advancement, regional flap, tissue expansion, and free tissue transfer. Free tissue transfers are stratified by planes of dissection used to raise the flaps. Musculocutaneous flaps include the muscle and overlying skin paddle, whereas fasciocutaneous flaps consist of cutaneous and subcutaneous tissue down to deep muscle fascia, sparing the muscle. Fasciocutaneous flaps can be subfascial, below the deep muscle fascia, or suprafascial, above the deep muscle fascia.<sup>1</sup> Recently, the advent of thinner suprafascial fasciocutaneous flaps has allowed for improved wound contour in complex reconstructions. A thin flap is dissected in the plane of the superficial adipose fascia, whereas a super thin flap is dissected above the superficial fascia including only the dermis and its superficial plexus.<sup>1</sup> Thinning can be done primarily at elevation or secondarily using scissors or Bovie after initial elevation of the flap.

The reconstructive ladder is an algorithmic management approach for scalp defects that proposes using the simplest feasible procedure and moving up in complexity only if necessary.<sup>2</sup> Other recommendations, such as the reconstructive elevator, consider factors such as defect etiology and patient risk factors to immediate consideration of complex operations when indicated in difficult cases rather than first attempting simpler techniques.<sup>3,4</sup> Regardless of the algorithm used, important considerations include the patient's medical and functional status; preferences and expectations of the result; medical and surgical history; the size, thickness, location, and status of the defect; whether the dura is exposed; and the materials used in the cranioplasty.<sup>2-4</sup> Additionally, prior radiation therapy or need for postoperative radiation can impact reconstructive options due to poor wound healing and skin inelasticity.<sup>5</sup> Wound healing capability, wound bed depth and vascularity, local tissue availability and elasticity, and size and location of the defect are all factors that may preclude simpler reconstructive techniques, necessitating consideration of a free tissue transfer.

The present case describes a patient with a history of advanced lung cancer with brain metastasis whose management course was complicated by wound breakdown and infection. After a failed initial reconstructive attempt, a super thin deep inferior epigastric perforator (DIEP) flap was used for definitive scalp coverage.

## CASE PRESENTATION

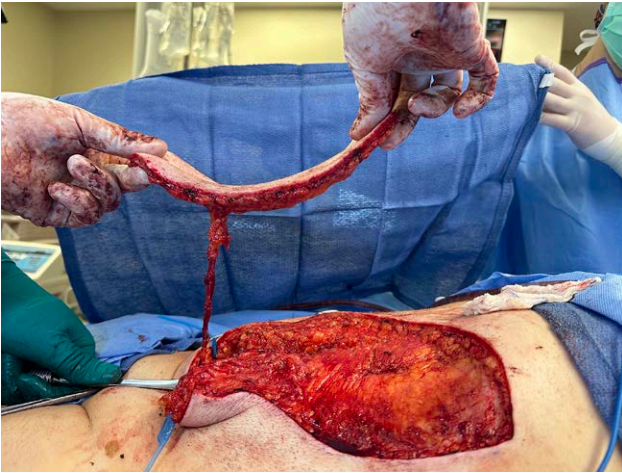
A 67-year-old man was referred to the plastic and reconstructive surgery clinic for management of a chronic scalp wound. In 2003, he was diagnosed with metastatic lung cancer that was treated with craniotomy and

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**Fig. 1.** Intraoperative view of super thin DIEP flap.



**Fig. 3.** Immediate postoperative view with Penrose drain in place.



**Fig. 2.** Intraoperative view of scalp before flap inset.

radiation therapy. In 2019, he sustained a scalp laceration at the craniotomy site that failed to heal and progressed to osteomyelitis. This prompted a biparietal craniectomy and rotational flap closure in April 2023. Unfortunately, his postoperative course was complicated by a 1×3 cm area of wound breakdown among tight radiated skin flaps. His medical history includes hypertension, hepatitis C, lung cancer, and seizures well controlled on Keppra. He is a lifetime nonsmoker.

Given his history of chronic wounds, previous failed local tissue transfers, and radiation therapy affecting the remaining scalp skin, the decision was made to proceed with cranioplasty using a custom 8×9 cm polyetheretherketone implant followed by coverage using a free super thin DIEP flap. A large left periumbilical perforator was identified on preoperative computed tomography angiography (CTA) to be used as the pedicle artery and anastomosed to the right superficial temporal artery. A 20×11 cm left oblique abdominal DIEP flap was designed with the pedicle located to the right side of the flap to achieve maximal length with the single perforator artery being able to reach the superficial temporal artery. The flap was dissected superficially to the Scarpa fascia, then incised and harvested, as shown in [Figure 1](#). Then, as shown in [Figure 2](#), a 10×13 cm area of nonviable scalp tissue was removed before the flap was laid into position and trimmed to properly fit the defect. A 2.5-mm venous coupler was used for an end-to-end venous anastomosis followed by the arterial anastomosis, which was approximately 1.5 mm in size. After the venous and arterial anastomoses, pulsatile flow in the flap was immediately observed without any venous dilation or engorgement. The pedicle was placed tension-free under the incision. The flap was inset, and a Penrose drain was placed underneath the flap and brought out behind the ear, as shown in [Figure 3](#). The donor site was reapproximated and closed in a layered fashion. A Prevena negative pressure wound dressing was placed on the abdominal incision due to some tension on the closure.

Postoperatively, the patient was monitored in the intensive care unit for neurological and flap checks initially every hour then every 4 hours, whereas inpatient until discharging home on postoperative day 4. At 1-week postoperative, there was a 15-mL serosanguineous fluid collection underneath the flap, which was aspirated using sterile technique. The Prevena dressing was also removed from the abdominal donor site at this time. The patient is now over 2 months postoperative and is healing well without complications, illustrated in [Figure 4](#). He has good cosmesis of his abdominal incision and anterior flap contour, with some increased bulkiness at the posterior contour for which the patient requests future thinning.



**Fig. 4.** Eight weeks postoperative view of super thin DIEP flap scalp reconstruction.

### DISCUSSION

Given the large defect size, need for cranioplasty using a polyetheretherketone implant, history of osteomyelitis, irradiated skin, and previous local flap failure, this patient's only option for adequate scalp reconstruction was via free tissue transfer. His high level of functionality, lack of peripheral vascular disease or other significant comorbidities, and surgical history further made him a suitable candidate for free flap reconstruction. Ultimately, a super thin DIEP flap was chosen for this case because it offered a long pedicle length and a thin wound contour. A DIEP flap was the superior choice compared with an anterolateral thigh perforator (ALTP) flap for this patient due to his body habitus; his thighs were larger in size, which would have made a thin dissection more difficult with potentially poorer contour. Preoperative CTA is beneficial in aiding with donor site selection and flap design.

There are several options available for free flap sources for scalp reconstruction, including various muscles, omentum, radial forearm, and ALTP flaps.<sup>6</sup> ALTP and DIEP flaps are the most advantageous option, as they provide a reliable blood supply, offer a large surface area that is elastic and can be thinned, and use muscle-sparing techniques to avoid functional deficits.<sup>7</sup> Additionally, ALT and DIEP flaps improve aesthetic outcomes by bringing hair-bearing skin to the scalp and allowing for the possibility of hair restoration procedures. As beneficial as fasciocutaneous flaps

can be, they do carry some associated risks, including long operative time, prolonged time under general anesthesia, and potential for flap failure.<sup>8</sup> Risk factors, including age, smoking, diabetes, operative time, and perioperative radiation, have been associated with an increased risk of flap failure, prompting appropriate preoperative evaluation and risk mitigation.<sup>9,10</sup> Notably, suprafascial, including thin and super thin, flaps do not carry any additional risk as opposed to the subfascial flaps.<sup>1</sup>

The present case is unique in describing the use of a super thin DIEP flap for a complex scalp reconstruction. It is important to note that although the DIEP flap is popularized for breast reconstruction, it does offer technical advantages within other realms of reconstruction among the right patient population.

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### DISCLOSURE

*The authors have no financial interest to declare in relation to the content of this article.*

### PATIENT CONSENT

*The patient provided written consent for the use of his image.*

### REFERENCES

- Rios S, Falguera-Uceda MI, Dean A, et al. Suprafascial free flaps: classification and comprehensive review of the literature. *Craniofacial Trauma Reconstr Open*. 2021;6:247275122110205.
- Desai SC, Sand JP, Sharon JD, et al. Scalp reconstruction: an algorithmic approach and systematic review. *JAMA Facial Plast Surg*. 2015;17:56–66.
- Park H, Min J, Oh TS, et al. Scalp reconstruction strategy based on the etiology of the scalp defects. *J Craniofac Surg*. 2022;33:2450–2454.
- Janus JR, Peck BW, Tombers NM, et al. Complications after oncologic scalp reconstruction: a 139-patient series and treatment algorithm. *Laryngoscope*. 2015;125:582–588.
- Haubner F, Ohmann E, Pohl F, et al. Wound healing after radiation therapy: review of the literature. *Radiat Oncol*. 2012;7:162.
- Altinkaya A, Yazar S, Sağlam I, et al. Reconstruction of extensive scalp defects with anterolateral thigh flap. *Ulus Trauma Acil Cerrahi Derg*. 2018;24:364–368.
- Costa DJ, Walen S, Varvares M, et al. Scalp rotation flap for reconstruction of complex soft tissue defects. *J Neurol Surg B Skull Base*. 2016;77:32–37.
- Othman S, Azoury SC, Tecce MG, et al. Free flap reconstruction of complex oncologic scalp defects in the setting of mesh cranioplasty: risk factors and outcomes. *J Craniofac Surg*. 2020;31:1107–1110.
- Eckardt A, Fokas K. Microsurgical reconstruction in the head and neck region: an 18-year experience with 500 consecutive cases. *J Craniofacial Surg*. 2003;31:197–201.
- Fischer JP, Sieber B, Nelson JA, et al. A 15-year experience of complex scalp reconstruction using free tissue transfer-analysis of risk factors for complications. *J Reconstr Microsurg*. 2013;29:89–97.