In-Vivo Quantitative Evaluation of Perfusion Zones and Perfusion Gradient in the Deep Inferior Epigastric Artery Perforator Flap

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**Background:** The selection of well-vascularized tissue during DIEP flap harvest remains controversial. While several studies have elucidated cross-midline perfusion, further characterization of perfusion to the ipsilateral hemiabdomen is necessary for minimizing rates of fat necrosis or partial fat necrosis in bilateral DIEP flaps.

**Methods:** Eighteen patients (29 flaps) underwent DIEP flap harvest using a prospectively designed protocol. Perforators were marked and imaged with a novel system for quantitatively measuring tissue oxygenation, the Digital Light Hyperspectral Imager. Images were then analyzed to determine if perforator selection influenced ipsilateral flap perfusion.

**Results:** Flaps based on a single lateral row perforator (SLRP) were found to have a higher level of hemoglobin oxygenation in Zone I (mean %HbO$_2$ = 76.1) compared to single medial row perforator (SMRP) flaps (%HbO$_2$ = 71.6). Perfusion of Zone III relative to Zone I was similar between SLRP and SMRP flaps (97.4% vs. 97.9%, respectively). These differences were not statistically significant (p>0.05). Perfusion to the lateral edge of the flap was slightly greater for SLRP flaps compared SMRP flaps (92.1% vs. 89.5%, respectively). SMRP flaps had superior perfusion travelling inferiorly compared to SLRP flaps (88.8% vs. 83.9%, respectively). Overall, it was observed that flaps were better perfused in the lateral direction than inferiorly.
**Conclusions:** Significant differences in perfusion gradients directed inferiorly or laterally were observed, and perforator selection influenced perfusion in the most distal or inferior aspects of the flap. This suggests broader clinical implications for flap design that merit further investigation.
Hyperspectral Image with Gradient Overlay. Sampling image pixels across the skin flap in the lateral and inferior directions, as indicated by the black arrows, results in plotting a decreasing tissue oxygenation gradient toward the flap edge from the perforator. A black x represents the skin flap perforators as identified by the surgeon.
This figure illustrates areas of maximal perfusion within the deep inferior epigastric artery perforator (DIEP) flap observed in this study.