**Molecular, Histologic, and Non-Invasive Imaging Assessment of Donor Site Healing Dynamics**


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**Introduction**

Autografting is the standard of care for burn wounds requiring excision. In harvesting autograft, a donor site (DS) wound is created that displays much of the same pathophysiology as the burn wound. Better understanding the physiology of DS healing may lead to advances in how these wounds are treated, and may ultimately allow more frequent autografting and more efficient care of the burn-injured patient. Unfortunately, a paucity of data exists in regards to perfusion metrics over the course of wound healing. Furthermore, there are no studies that interrelate indices of perfusion with the cellular and molecular processes of DS healing.

**Methods**

Male Duroc pigs were anesthetized and DS wounds were created using a Zimmer dermatome at 0.060 inch depth. Digital photographs, laser Doppler images (LDI), and punch biopsies were obtained pre- and post-excision and on days 2, 4, 7, 9, 11, 14, and 16 until wounds were healed. RNA isolation and cDNA synthesis were performed, and qPCR was used to quantify gene expression. Formalin-fixed biopsies were paraffin-embedded, sectioned, H&E stained, and examined.

**Results**

Wounds were 83% re-epithelialized by day 16 (fig 1, 2). Perfusion peaked on day 2, then declined but remained significantly elevated compared to pre-excision (fig 3). From day 9 onward, mean perfusion units were not significantly different from baseline (fig 3). Twenty two representative genes were selected to represent functional groups of interest. Relative to baseline, elevated RNA expression of extracellular matrix proteins, inflammatory cytokines, remodeling enzymes, growth factors, and WNT was observed (fig 5). Nuclei per high powered field peaked at day 7 and neodermal thickness increased daily to day 14 (fig 6).

**Conclusion**

We present a novel, porcine model for donor site wound healing that interrelates wound perfusion with molecular and cellular indices of wound healing. This provides a more fully characterized understanding of the physiology and dynamics of donor site healing. Future efforts are aimed at investigation of abnormal healing and development of therapeutic interventions based on identified biomarkers.

**Figure 1:** Digital photos post-excision (A), day 7 (B), and day 16 (C)

**Figure 2:** Percent re-epithelialization throughout time course

**Figure 3:** Mean perfusion units throughout time course. (* significantly different from pre-excision, p < 0.05)

**Figure 4:** LDI Flux images at day 2 (A) and day 9 (B)

**Figure 5:** Upregulated gene expression. Red denotes significance (p < 0.05) relative to baseline and reference gene using the ΔΔ Ct method.

**Figure 6:** Representative photomicrograph at 40x magnification of H&E stained punch biopsy at day 7 with black bar representing neodermis (A), neodermal thickness w/ SEM (B), and density of nuclei per HPF at 1000x throughout time course (C).