Commercially Available Topical PDGF as a Novel Agent to Accelerate Burn-Related Wound Healing

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Introduction

When autologous skin grafts are required, donor site wound healing becomes a concern in addition to the burn site. Donor site healing affects length of stay, pain control, and participation in rehabilitation. In large burns, repeated harvesting of a single donor site is common. Platelet derived growth factor (PDGF) is released by platelets, macrophages, endothelial cells, and fibroblasts and encourages local protein and collagen production. PDGF is efficacious in promoting wound healing in diabetic foot ulcers in both human and animal models. We investigated whether the application of PDGF to donor site wounds would speed healing in a porcine model.

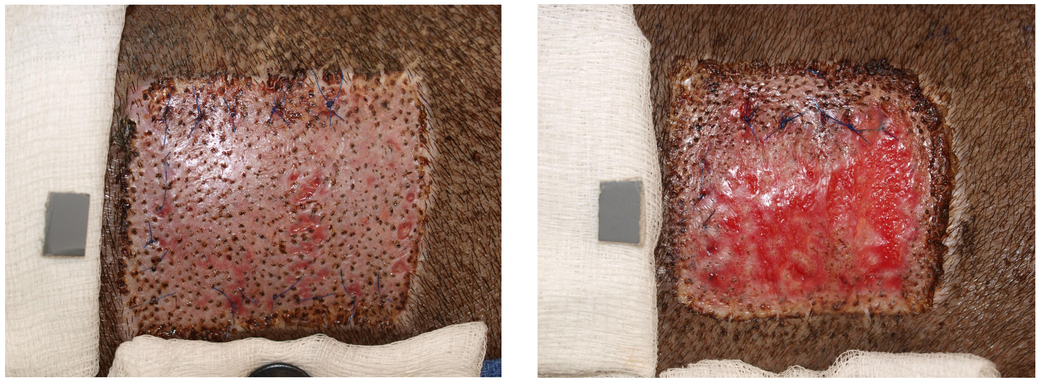

Figure 1. Digital photos of PDGF-treated (Left) and control (Right) wounds at day 9.

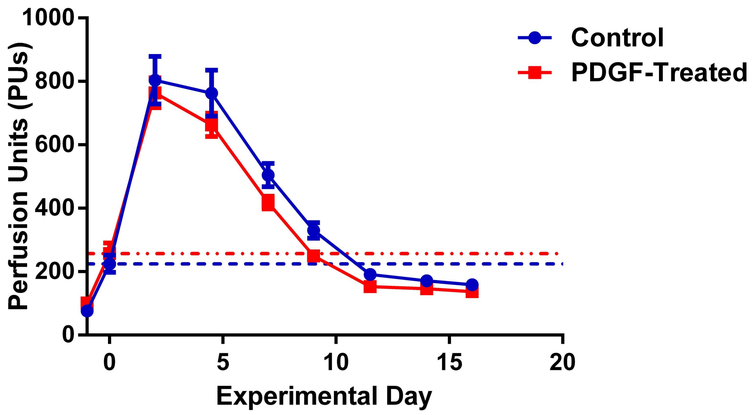

Figure 5. LDI perfusion unit measurements with dotted and dashed lines marking excision-time levels.

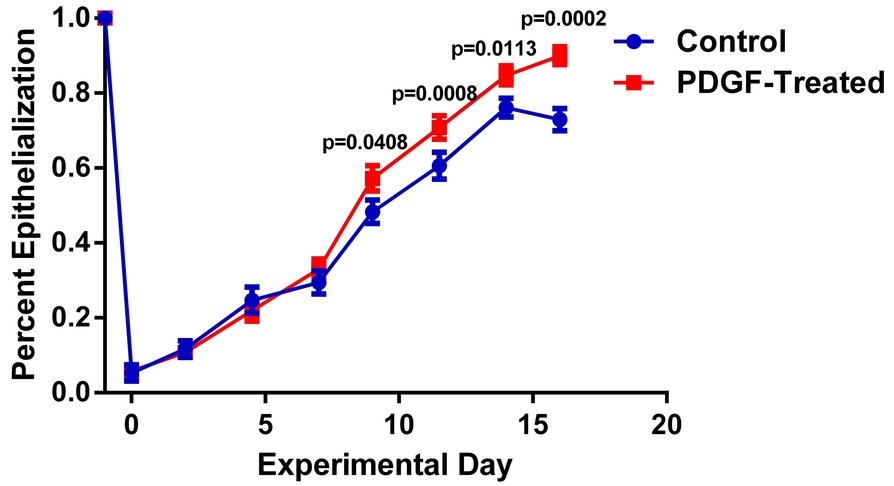

Figure 2. Percent epithelialization by digital photo analysis. Significant differences noted with p values.

Methods

In a red duroc pig model, three 3" x 3" wounds were created with a dermatome (0.06" depth) on one side of 2 different animals. These wounds were digitally and laser Doppler (LDI) imaged and biopsied immediately pre- and post-wound creation and every 2 days for 2 weeks. A set of identical wounds were subsequently created on the opposite side of the same animals and treated with topical PDGF (becaplermin gel 0.01%, 4 g/wound) immediately upon wounding. PDGF-treated wounds were imaged and biopsied as above. Digital images of wounds were assessed for epithelialization by clinicians using an ordinal scale. Perfusion units (PU) were evaluated by LDI.

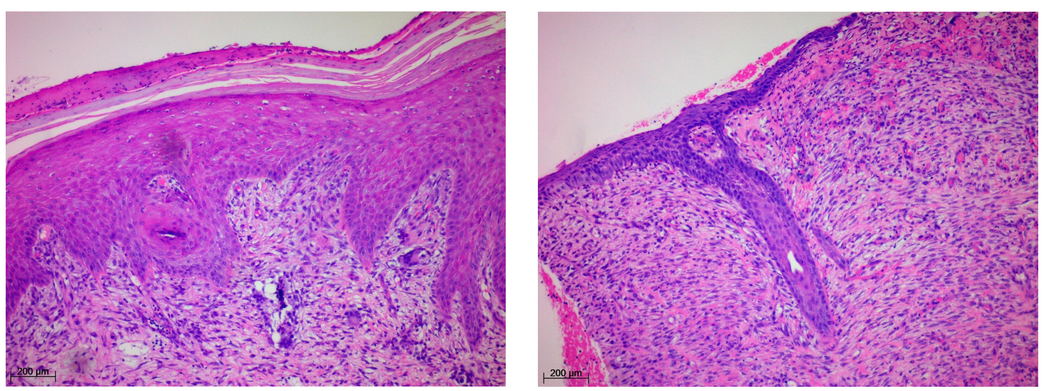

Figure 4. PDGF-treated (Left) and control (Right) wounds at day 9 (H&E at 400x).

Results

On day 9, PDGF-treated wounds were, on average, 57.2% epithelialized versus 48.3% epithelialized for control wounds (Fig. 2; n=36, p=0.0408). This trend continued through day 16, when PDGF-treated wounds showed an average of 90% epithelialization by digital imaging and control wounds showed an average of 72.9% epithelialization (Fig. 2; n=24, p=0.0002). Control wounds showed evidence of partial epithelialization at an average of 7.7 days post-wound creation, while PDGF-treated wounds showed the same at an average of 6.4 days post wound-creation (Fig. 3; n=9, p=0.0235). Control wounds showed evidence of full epithelialization with an intact basement membrane and complete epithelial cell layer at an average of 11.7 days post-wound creation, while PDGF-treated wounds showed the same at an average of 9.6 days post-wound creation (Figs. 3,4; n=9, p=0.0182). Control wounds maintained higher PU values compared to PDGF-treated wounds at all time points (Fig. 5) and returned to PU values like those seen immediately after wound creation in an average of 9.7 days, whereas control wounds did the same in an average of 12.5 days (Fig. 6; p=0.0029).

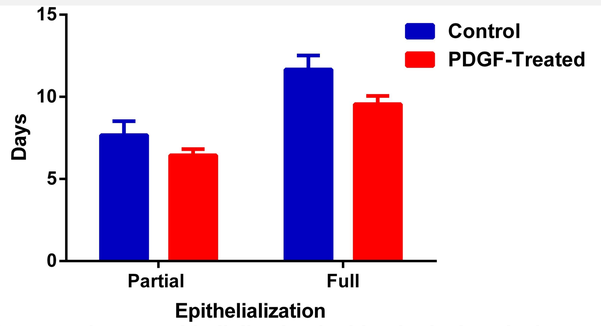

Figure 3. Time to epithelialization by histological analysis.

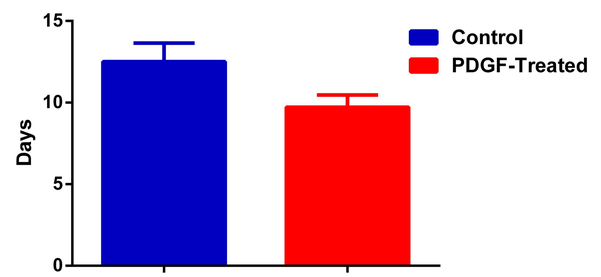

Figure 6. Time to return to excision-level perfusion by LDI analysis.

Conclusion

We conclude that topical PDGF speeds time to epithelialization of partial thickness wounds in a porcine model as evidenced by histology, clinical appearance, and time to return to pre-wounding vascularity.