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# Effects of Autologous Fat and ASCs on Swine Hypertrophic Burn Scars: A Multimodal Quantitative Analysis

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**Background:** Hypertrophic scar formation is unpredictable and poorly understood, afflicting both the pediatric and adult populations. Treatment methods with conservative and invasive approaches have low rates of compliance and high rates of morbidity. The purpose of this study was to test a reproducible scar model and investigate a new technique of scar modification through the use of adipose-derived progenitor stromal cells (ASCs).

**Methods:** Twenty thermal deep-partial thickness contact burns were created on the dorsum of three 8-week-old domestic swine and allowed to mature for 10 weeks. Scars were then injected with 2 cc saline, expanded autologous ASCs, or 2 cc fresh lipoaspirate and sampled at 2 week intervals up to 10 weeks postinjection. Volumetric analysis with a 3-D scanner, mechanical elasticity testing through negative pressure transduction, and standardized photography evaluation with Image J was performed. RNA sequencing was performed on scar tissue samples, cultured cells, and fresh lipoaspirate to determine relevant gene transcription regulation. Immunohistochemistry was used to verify expression level changes within the scars.

**Results:** Volumetric analysis demonstrates a reduction in average scar thickness at 6 weeks when injected with ASCs (-1.6 $cc^3$) and autologous fat (-1.95 $cc^3$) relative to controls (-0.121 $cc^3$; $P < 0.05$). A decrease in overall tissue compliance is observed with fat or ASC injection when compared with unburned skin at 8 weeks (35.99/37.94 versus 49.36 mm Hg × mm; $P < 0.01$). RNA sequencing demonstrates altered regulation of fibroblast gene expression and a decreased inflammatory profile when scars are injected with autologous fat/ASCs over controls.

**Conclusion:** Early results suggest that autologous fat and/or ASCs may improve healing of hypertrophic scarring by altering the cellular and structural components during wound remodeling up to 20 weeks after injury. This may have beneficial applications in early treatment of large or cosmetically sensitive immature burn scars.
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## INTRODUCTION

Survival from thermally induced injuries has significantly improved in recent history, yet advances in aesthetic and functional outcomes inflicted by the resulting hypertrophic burn scar have not kept pace. Current modalities for the treatment of hypertrophic scars are not uniformly predictable, often relying on patient compliance and may potentially increase morbidity. The traditional surgical approach aimed at prevention of hypertrophic scarring is early excision and skin grafting of deep thermal injuries

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