Enhancing stem cell wound healing with nanofeatured scaffold*

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April 30th, 2015
11:30 am, 306 Egan Hall

Current treatment options for serious and chronic wounds are drastic and inadequate; frequently, the only option for serious skin ailments is to surgically insert a skin graft which suffer from a lack of vascularization, inability to participate in the epithelium, loss of elasticity, scarring, and increased risk of infection from the surgical environment. There are an estimated 3-7 million cases of chronic wounds each year, and that number is highly likely to increase in the coming years, as the population ages. In direct spending alone, treatment of chronic wounds costs over $25 billion per year; this does not reflect the indirect cost such as losing time from work, reduced productivity, disability payments, rehabilitation, or the physical and emotional toll caused by chronic wounds.

Mesenchymal stem cells (MSCs) have shown good cell signaling properties that promote wound healing. MSCs are self-renewing multipotent stem cells that can differentiate into tissues of mesenchymal lineage such as bone, cartilage, tendon, and fat. MSCs are ubiquitous in the body and may be sourced from bone marrow, adipose, umbilical cord, and placenta. *In vivo* injection of MSCs in wounds has increased rates of wound closure, re-epithelialization, angiogenesis, upregulation of wound healing factors, and recruitment of endogenous stem cells in animal models. However, use of matrix for regulating wound healing properties have not been investigated despite previous research that shows the synergistic effect of physical cues on the differentiation of MSCs.

Here a model system using polydimethylsiloxane (PDMS) grafted with leucine, leucine-37 (LL-37), an antimicrobial peptide, is proposed to study the effect of physical and chemical cues for enhancing wound healing properties. The elastic modulus of the PDMS scaffold will be varied along with the amount of adsorbed LL-37. *In vitro* cell assays will assess the effect of MSCs on re-epithelialization, angiogenesis, and inflammation. Animal studies will commence upon completion of *in vitro* experiments.

*This work is supervised by Professor Thomas J. Webster, Department of Chemical Engineerng