Alleviation of Sarcopenia Using Mechanical Strain-Induced Myogenic Stem Cells

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Key Research Aims and Goals

To determine optimal conditions for synthesizing stem cells in vitro that can be used for restoration of mass and function in aged skeletal muscle

Highlights and Results

- In January 2012, we reported the ability for muscle-derived mesenchymal stem cells (mMSCs) to upregulate stem cell markers and optimally synthesize IGF-1 in response to mechanical strain in the presence of laminin.[1]
- Recently, we completed a protein array to determine whether mMSCs secrete other factors in response to strain and laminin that facilitate growth of muscle and muscle-related vasculature. The release of EGF (4.2-fold), VEGF (1.5-fold), and GM-CSF (3.1-fold) support our in vivo studies in which vessel size is enhanced by mMSC transplantation. Increases in vessel size, muscle growth, and muscle strength with mMSC transplantation suggest mMSCs may provide a novel intervention for sarcopenia.

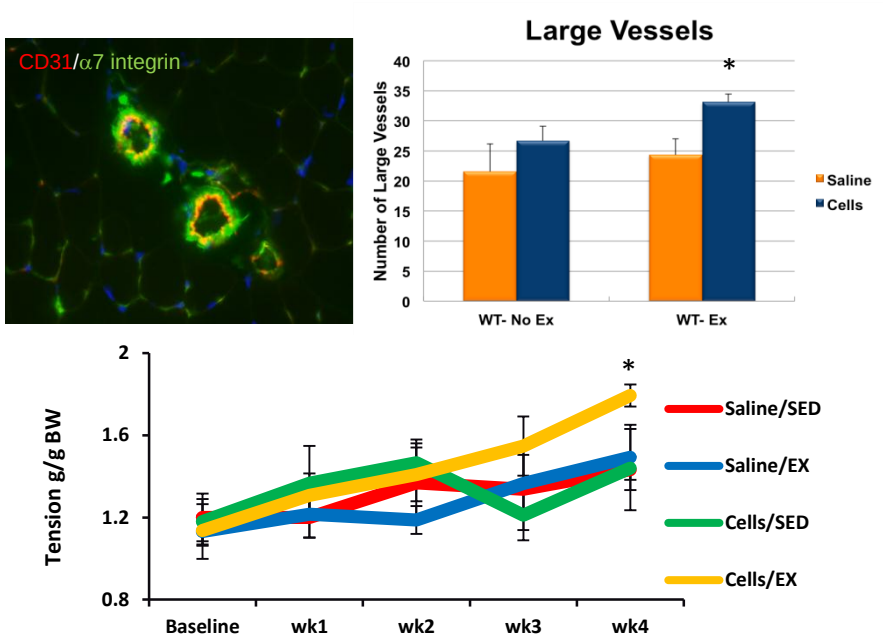

Fig 1 (left) Image showing CD31⁺ vessels in skeletal muscle. (right) Total number of large CD31⁺ vessels is increased in response to mMSC transplantation and exercise training (Ex). (bottom) Muscle strength is increased with mMSC transplantation and exercise training (EX).

Future Research Plans

- To investigate whether mMSCs subjected to mechanical strain on laminin-coated silicone membranes prior to injection (preconditioning) can facilitate the ability for mMSCs to restore muscle mass and function with age.
- To determine whether laminin incorporation into 3D (collagen) hydrogels can restore mMSC ability to release growth factor in response to strain.

[1] Valero et al. Eccentric exercise facilitates mesenchymal stem cell appearance in skeletal muscle . PLoS One. 2012; 7: e29760.