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CYR61 improves muscle force recreation in a rabbit trauma model

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Abstract

Purpose: Critically elevated compartment pressures after complicated tibial fractures can result in scarring of muscles with impaired function. Several studies have shown a relationship between angiogenesis and more effective muscle regeneration. Cysteine-rich angiogenic inducer 61 (CYR61) is associated with angiogenesis but it is not clear whether it would restore muscle force, reduce scarring or improve angiogenesis after acute musculoskeletal trauma. Therefore, we asked whether local application of CYR61 (1) restores muscle force, (2) reduces scar tissue formation, and (3) improves angiogenesis.

Methods: We generated acute soft tissue trauma with increased compartment pressure in 22 rabbits and shortened the limbs to simulate fracture debridement. In the test group, a CYR61-coated collagen matrix was applied locally around the osteotomy site. After 10 days of limb shortening, gradual distraction of 0.5 mm per 12 hours was performed to restore the original length. Muscle force was measured before trauma and on every fifth day after trauma. Forty days after trauma we euthanized the animals and histologically determined the percentage of connective and muscle tissue. Immunohistology was performed to analyze angiogenesis.

Results: Recovery of preinjury muscle strength was significantly greater in the CYR61 group (2.8 N; 88%) as compared to the control (1.8 N; 53%) with a moderate reduction of connective tissue (9.9% vs. 8.5%). Immunohistochemical staining showed that blood vessel formation increased significantly (trauma vs. control 38.75±27.45mm^2 vs. (24.16±19,81mm^2)).

Conclusions: Local application of CYR61 may improve restoration of muscle force by improving angiogenesis and moderately reducing connective tissue.

Biography

Sönke Frey has completed his doctoral degree at the University of Münster, Germany. Before he had studied medicine in Münster, Germany, in Perth, Australia and in Boston, USA. For his doctoral thesis he developed a non-invasive method to measure muscle force in small animals. He works as a senior orthopaedic surgeon at a Level I trauma center at the University of Würzburg, Germany. His main research interest is the regeneration of traumatized tissues. He has published several papers in international reputed journals on tissue regeneration after trauma.