

BIOCHEMICAL AND BIOMECHANICAL EVALUATION OF THE FLEXOR TENDON REPAIR SITE

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INTRODUCTION

Our research has focused on the healing of lacerated flexor tendons. Recent research has sought to quantify the temporal accumulation of VEGF at the repair site during the intrinsic angiogenic process that accompanies early healing, and evaluate if a rehabilitation protocol accelerates the maturation of repaired intrasynovial flexor tendons.

METHODS

Twenty-four flexor digitorum profundus tendons from 12 adult dogs were transected and repaired. The animals received either low-force or high-force rehabilitation. Animals were sacrificed 10, 21 or 42 days after surgery, and a 10 mm segment of tendon surrounding the repair site was harvested. These segments were evaluated for collagen content and cross-links.

To evaluate the time course of the VEGF mRNA accumulation during the early stages of flexor tendon healing, flexor digitorum profundus tendons were transected and repaired. Animals were sacrificed at 4, 7, 10 and 17 days after surgery. VEGF expression was evaluated by in-situ hybridization with a radiolabeled antisense riboprobe.

RESULTS AND DISCUSSION

In the first study, biochemical analysis revealed that the total collagen content was significantly reduced at each time point ($p < 0.05$) and that the reducible crosslink ratio of DHLNL/HLNL was significantly

increased at each time point after surgery. The flexor tendon site is still immature at six weeks post-operatively from the standpoint of collagen content and crosslink maturity. Since we have previously observed increases in biomechanical strength of the repair site between three and six weeks, factors other than increased collagen synthesis or altered repair-site collagen maturity must be involved. There was no difference in collagen content or cross-link values between low and high-force rehabilitation groups at any time point ($p > 0.05$). The higher level of force used during the rehabilitation protocol did not accelerate the maturation of the repaired tendons, in contrast with prevailing clinical concepts.

In the angiogenesis study, selective accumulation of VEGF mRNA occurred at the intrasynovial flexor tendon repair sites as early as 4 days post-operatively, with peak levels achieved at 7 and 10 days post-operatively. Local VEGF mRNA expression at the repair site temporally preceded and was spatially distinct from the vascular ingrowth itself, which occurs maximally at day 17. This is the first report on the time course of VEGF mRNA accumulation during the early stages following intrasynovial flexor tendon repair and rehabilitation. These data support the concept that cells within the flexor tendon repair site are involved in angiogenesis, not only the synthesis of extracellular matrix.