The Effects Of Basic Fibroblast Growth Factor on Acute Rotator Cuff Injury In A Rat Shoulder Model

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**Introduction:** There is a high incidence and prevalence of rotator cuff disease. Laboratory studies using growth factors that accelerate the formation of tendon tissue and accelerate the strength of a healing tendon could have the potential of accelerating the post-operative rehabilitation after rotator cuff repair. We hypothesized that addition of rbFGF after an acute injury to the rotator cuff tendon would increase early strength and biomechanical healing parameters, and administration of rbFGF on intact tendon would have no effect.

**Materials and Methods:** The Infraspinatus tendons of 49 shoulders of 350 grams – 400 gram male Sprague Dawley rats were exposed to recombinant basic fibroblast growth factor (rbFGF) or vehicle control. An additional 6 shoulders served as control tendons for comparison to intact tendons exposed to rbFGF. For the injury model, 2 groups had surgically created 1mm (half tendon width) full thickness defect 2mm from the insertion site on the humerus. A dose of 200ng of rbFGF or vehicle control (Alginate) was administered to randomly chosen rats. A third group received 200ng of rbFGF on an intact tendon. Tendons were harvested 1 week, 2 week and 4 weeks. In all groups, the Infraspinatus tendon was dissected, isolated and left attached to the humerus. In the injury model, after dissection and prior to testing, the intact portion of the injured tendon was divided across tendon fibers at the level of the injury leaving only the healing granulation tissue in continuity with the remaining proximal and distal portions of the tendon and loaded to failure. In the second model, uninjured intact rbFGF treated tendons and the control tendons were loaded to failure.

**Results:** In the injury model, the week 1 injury group's average load to failure was 0.60N versus 0.61N in the rbFGF injury group P = 1.000. At 2 weeks, the injury group's average load to failure increased to 1.03N versus 2.08N in the rbFGF injury group P = 0.440. At 4 weeks, the injury group's average load to failure increased to 3.93N versus 5.56N in rbFGF P = 0.013 representing a 41% increase in ultimate load. At 4 weeks, the granulation tissue size of the injury group was 0.4mm2 versus 2.7mm2 in the rbFGF injury group P < 0.001. Stiffness at 4 weeks for the injury tendons was 2.15 N/mm versus 3.54 N/mm in the rbFGF treated group P = 0.006. However, stress measured 8.19 MPa in the injury group which was markedly high than the rbFGF treated group 2.07 MPa P < 0.001. Stress at the previous two time points did not differ statistically.

In the intact tendon model, both uninjured untreated tendons did not differ from rbFGF treated untreated uninjured tendons in ultimate load to failure, 36.38N versus 43.67N respectively P = 0.931. No difference was seen in the tendon area measurements of untreated intact tendon 1.8mm2 versus 2.0mm2 in intact tendon with treated with rbFGF P = 0.320. No difference was seen in stiffness in the intact uninjured tendons 20.34 N/mm versus 20.24 N/mm in intact tendon treated with rbFGF P = 1.000. No difference was seen in stress of rbFGF treated vs untreated tendon 19.81 MPa vs 20.83 MPa respectively P =0.996

**Discussion:** At 4 weeks healing tissue of acutely injured rotator cuff exposed to rbFGF has an increase in ultimate load to failure (41% compared to control), stiffness and area of healing tendon granulation size when exposed to rbFGF. Uninjured tendons exposed to rbFGF do not differ from control in ultimate load to failure, stiffness and size of tendon at 4 weeks. However, stress is markedly less at this time indicating that the ultimate load to failure increase is largely the function of increased area of the healing tendon.

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1mm partial tenotomy created surgically on the inferior portion of Infraspinatus 2mm from its insertion.