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SPOTLIGHT ON sports medicine

Human Growth Hormone May Be Detrimental When Used to Accelerate Recovery From Acute Tendon-Bone Interface Injuries

Baumgarten KM, Oliver HA, Foley J, Chen DG, Autenried P, Duan S, Heiser P. *J Bone Joint Surg Am.* 2013; 95(9):783-789. doi: 10.2106/JBJS.L.00222.

Each month, this column summarizes a Level I article and provides a thought-provoking review on how the treatment in the article has either stood the test of time or serves as an example of how conventional wisdom has changed.

Anecdotal and conflicting experimental evidence exist regarding the role of human growth hormone in recovery from injury. The authors hypothesized that tendon-to-bone healing would be accelerated in rats after acute rotator cuff repair for those administered human growth hormone compared with control rats treated with a placebo. Mechanical testing was performed to verify the hypothesis.

Two protocols were used in the study. For Protocol 1, researchers repaired acute rotator cuff injuries in 72 rats before randomly assigning them to either the placebo or human growth hormone groups. Those placed in the human growth hormone group received 0.1, 1, 2, 5, and 10 mg/kg of human growth hormone administered subcutaneously once per day for 14 days.

For Protocol 2, twenty-four rats were randomly assigned to receive placebo or human growth hormone. Those placed in the human growth hormone group received 5 mg/kg of human growth hormone administered subcutaneously twice per day for 7 days preoperatively and 28 days postoperatively.

All rats were euthanized 28 days postoperatively to determine the ultimate stress, ultimate force, stiffness, energy to failure, and ultimate distension.

In Protocol 1, researchers found that the analysis of variance testing showed no significant difference between the groups with regard to ultimate stress, ultimate force, stiffness, energy to failure, or ultimate distension. However, in Protocol 2, ultimate force to failure was significantly worse in the human growth hormone group vs the placebo group. Compared with the placebo group, failure was also more likely to occur through the bone vs the tendon-bone interface in the human growth hormone group. The researchers found no significant differences for ultimate stress, ultimate force, stiffness, energy to failure, or ultimate distension between the groups in Protocol 2.

These data indicate that human growth hormone has no positive biomechanical effect and may be detrimental when used in the treatment of acute tendon-bone interface injuries in a rat model.

Daily subcutaneous human growth hormone treatment administered to rat models for 14 days after acute tendon-bone injury repair demonstrated no significant difference in any biomechanical parameter compared with placebo. Furthermore, the growth hormone demonstrated lower loads to ultimate failure and a higher risk of bone fracture failure compared with placebo when subcutaneously administered pre- and postoperatively.

REVIEW
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Human growth hormone has been used by athletes and clinicians alike as a means of accelerating recovery after injury. Firm scientific evidence for its efficacy in enhancing soft tissue repair is lacking. Growth hormone has an anabolic effect on muscle growth by increasing sarcomere amino acid and glucose uptake while it potentiates lipolysis. Indeed, many aging athletes regard it as the fountain of youth. Human growth hormone accelerates collagen synthesis; thus, the authors of the article ask a pertinent question about its effects on tendon-bone healing.

This fairly well-designed prospective study indicates that systemically administered human growth hormone confers no anabolic effect on rotator cuff repair and may prove deleterious to healing in higher dosing schedules. The rat model for rotator cuff disorders is well established and appears to correlate well to the human condition.

Although slightly underpowered, this investigation is another testament of failure in search of the "Holy Grail" of cuff healing enhancement. The inconsistent results of platelet-rich plasma —with noted potential negative effects—mirror those of this study. Of note, the prolonged dosage group gained appreciable weight, raising the specter of adverse metabolic consequences with human growth hormone administration (ie, hyperglycemia). Weight gain and its accompanying metabolic syndrome is proinflammatory and is associated with increased cytokine production. Perhaps modulation of inflammation will prove to be the most effective means of enhancing soft tissue repair. Before I give my patients human growth hormone, which promotes hypertension, hyperglycemia, and acromegaly, I would much rather choose tight glucose control, smoking cessation, and vitamin D and omega 3 fatty acid supplementation to mitigate inflammation and enhance healing.

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