**NEUROTIZATION VS. STANDARD NERVE REPAIR: A COMPARISON OF SURGICAL TECHNIQUE IN AN ANIMAL MODEL OF CHRONICALLY DENERVATED MUSCLE**

*Swanson, A N; *Doty S; *Khazzam M; *Feinberg J; **Shum C; *Ehteshami J; *Wolfe, S W  
*Department of Orthopaedics, Hospital for Special Surgery, New York, NY  
swansona@hss.edu

**INTRODUCTION:** Reinervation of chronically denervated muscle is clinically unpredictable and poorly understood on a biological basis. Current operative strategies include either direct nerve repair, nerve grafting, nerve transfer, or neurotization of the affected muscle with a proximal donor nerve. The goal of the present study is to compare the quality of muscle recovery using microneural repair versus direct nerve-to-muscle implantation (neurotization) in a rat model of chronic denervation.

**METHODS:** Forty-two Sprague-Dawley rats underwent surgical denervation of the tibialis anterior muscle by transecting the common peroneal nerve. After 0, 8 or 12 weeks of denervation, animals were assigned to either a direct repair cohort (a freshly axotomized common tibial nerve was coapted to the distal common peroneal nerve stump) or a neurotization cohort (a freshly harvested peripheral nerve graft was coapted to a freshly axotomized common tibial nerve and the distal end directly implanted into the tibialis anterior muscle). An additional five animals were used for a “sham” cohort (no surgical denervation) and six animals used for a control group (no surgical repair). After a twelve week recovery period, animals underwent functional testing of the tibialis anterior muscle using electrical stimulation to generate a tetanic contraction. Peak force and electromyographic characteristics (latency and amplitude) were compared to the unoperated, contralateral limb. Tibialis anterior muscles were then harvested for mass and histologic evaluation.

**RESULTS:** Forty-five animals completed histologic and physiologic testing. Denervated control animals demonstrated a significant decrease in muscle mass, contractile strength and peak EMG amplitude compared to “sham” animals. Repaired animals tended to perform better than neurotized animals with respect to muscle mass, contractile strength and peak EMG amplitude after 0, 8 and 12 weeks denervation (Figures 1, 2). Differences in contractile force were only significant in the 0 week denervation group (94 ± 30% vs. 50 ± 20%, Repair vs. Neurotization; p=0.01). In all groups, duration of denervation adversely affected mass, contractile strength and EMG characteristics. Neurotized muscles processed for histologic analysis demonstrated acetyl-cholinesterase activity at the nerve-muscle interface, confirming the formation of motor end-plates de novo.

**DISCUSSION:** Although animals in the neurotization group demonstrated the ability to reinnervate a chronically denervated muscle via a peripheral nerve graft bridge, animals in the direct repair group consistently performed better with respect to contractile strength, muscle mass and electromyographic characteristics. Recent work has focused on the inability of Schwann cells within the chronically denervated distal stump to support axonal reinnervation [1,2]. To date, evidence from this study does not support the hypothesis that muscle neurotization is superior to standard nerve repair for functional restoration of chronically denervated muscle. As the duration of denervation increases, however, neurotization may be more efficacious than direct nerve repair for functional muscle recovery.


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