**A Reverse End-to-Side Sensory Nerve Transfer Preserves Muscle Mass**

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**Background:** Functional recovery after a motor nerve repair decreases as the regenerative distance from the injury to end-organ target increases due to irreversible muscle atrophy. The ability of sensory nerves to prevent muscle atrophy is well-known (1, 2). Previously described sensory protection methods, however, involve direct implantation of sensory fibers into target muscle or a secondary procedure to re-establish motor regeneration. The purpose of this study is to evaluate sensory protection of muscle mass using a reverse end-to-side sensory nerve transfer, a technique that can be performed as a single stage at the time of the motor nerve repair. We hypothesize that a reverse end-to-side (RETS) transfer of a sensory nerve to the side of a regenerating motor nerve will preserve target muscle mass, prevent muscle atrophy, and ultimately improve motor function.

**Methods:** Sixteen male Lewis rats underwent randomization into two groups. The experimental group (n=8) received a tibial nerve transection with the proximal stump capped and turned into adjacent musculature. The distal tibial nerve then received a RETS sensory transfer using the saphenous nerve. In the control group, the tibial nerve was transected, capped and buried alone. At nine weeks, the gastrocnemius and soleus muscles were harvested bilaterally for muscle mass measurement and immunohistochemical analysis. Concomitantly, the distal tibial nerve stumps were harvested for histomorphometry.

**Results:** After normalization to the contralateral limb, the median muscle mass of the gastrocnemius was significantly greater in the experimental group than the control group ($p<0.05$, Neuman Keuls post-hoc). The normalized muscle mass of the soleus was also greater in the experimental group (Figure 1). Nerve histomorphometry confirmed the presence of axonal growth from the saphenous nerve into the tibial nerve. On immunohistochemical analysis sensory axons were observed to be present in the muscle, but axons were not found innervating the motor end-plates (Figure 2).

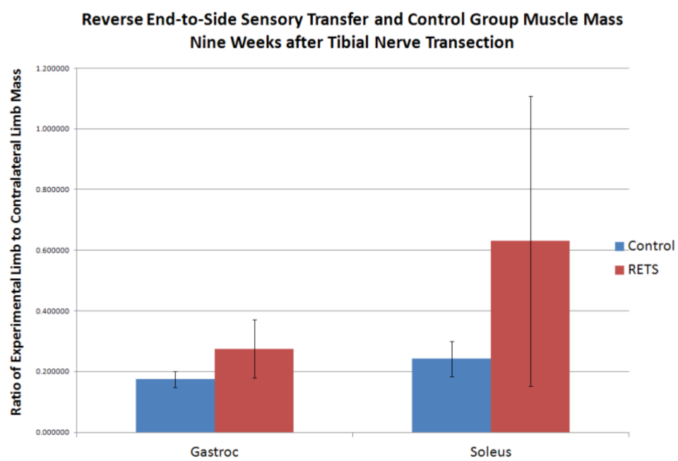
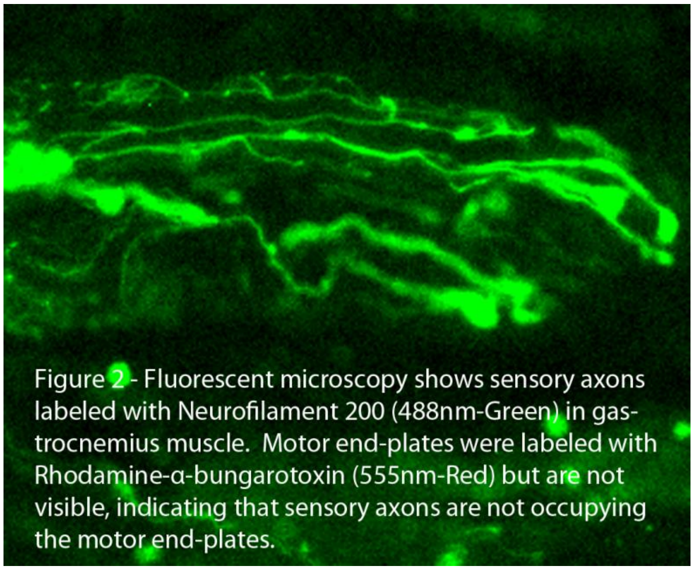



Figure 1 – Muscle mass was preserved at 9 weeks in the group that underwent reverse end-to-side (RETS) sensory nerve transfer at the time of nerve injury. Columns represent mean muscle mass after normalization to the contralateral, non-operative limb. Error bars represent standard deviation.




**Conclusions:** Proximal motor nerve injuries cause devastating functional disability due to long regenerative distances (3, 4). This study demonstrates that a RETS sensory nerve transfer preserves muscle mass. This technique allows motor axons to regenerate proximally while the muscle is preserved distally. Studies evaluating the impact on muscle force are underway. This procedure may prove useful for preserving muscle without significant donor site morbidity in the treatment of proximal motor nerve injuries.

**References:**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**Financial Disclosure:**

This work was supported by the Plastic Surgery Foundation Pilot Research Grant, 2013. None of the authors has any financial interests related to the contents of this manuscript.