

# Does Functional Neuromuscular Electrical Stimulation (NMES) Influence Calf Atrophy Following Achilles Tendon Surgery? Prospective Double Blind Randomized Controlled Trial on the Use of Immediate Postoperative Electrical Muscle Stimulation to Preserve Muscle Function and Volume

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## INTRODUCTION

Post-surgical muscle atrophy is common after Achilles tendon repair and immobilization. Muscle atrophy takes significant rehabilitation effort and time to recover. Though not elucidated, neuromuscular electrical stimulation (NMES) has been shown to improve pain and accelerate recovery following orthopedic surgery. We theorized muscle atrophy is a critical link to positive patient outcomes and that NMES could be a muscle volume preserving mechanism. It was theorized NMES used immediately after surgery and through the course of immobilization could mitigate calf muscle atrophy, improve postoperative patient reported scores, and perhaps speed functional recovery of Achilles tendon repairs.

## METHODS

This was an IRB approved, prospective, double blind, randomized controlled trial. Pre- and postoperative measurements of calf circumference, Focus on Therapeutic Outcomes (FOTO) Scores, and AOFAS ankle-hindfoot scores were measured. All subjects had MRI scans pre- and postoperatively (weeks 2 and 6) to measure cross sectional muscle volumes. A four lead NMES device was applied at time of surgery with patient and surgeon blinded to activity of the device (20 active, 20 'sham'). A standardized postoperative protocol was followed.

## RESULTS

There were 40 subjects with a mean age and BMI of 48.9 years and 32.2, respectively. There were no differences in demographic characteristics or preoperative scores between groups. The active treatment group trended toward higher FOTO and AOFAS scores at postoperative weeks 2 and 6, though not statistically significant, and both groups were similar at 12 weeks. Volumetric MRI measurements of the calf trended toward less muscle loss in the active treatment group at 6 weeks postoperative, but failed to reach statistical significance. Calf circumference measurements were not different between groups at any interval. Both groups used the devices similarly, but there was a 6.4% incidence of stimulator use on an incorrect setting (8% in active, 5% in sham), which was statistically significant ( $p < 0.001$ ).

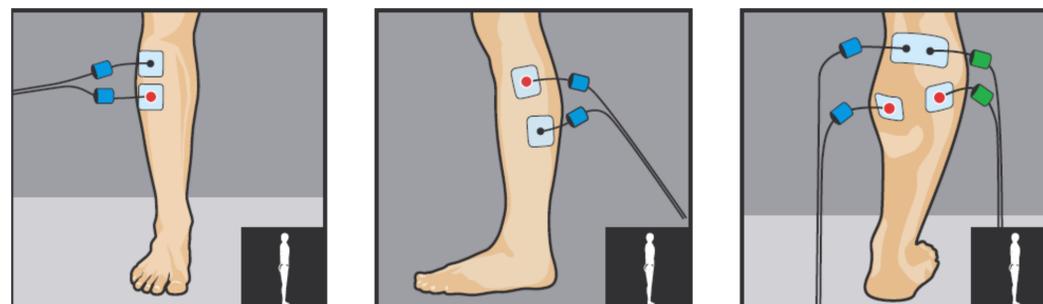


Figure 1: Electrode placement guide.

Measure	Preoperative	Postoperative
Calf size	✓	✓
FOTO score	✓	✓
AOFAS hindfoot	✓	✓
MRI leg	✓	2 and 6 weeks

Table 1: Pre- and postoperative measures.

## DISCUSSION

This study was undertaken to quantify and validate the effect and ability of NMES to minimize calf atrophy. No statistically significant difference was found between treatment groups. It is possible the reported beneficial effect of NMES is due to an induced cortical plasticity that would manifest later in the rehabilitation cycle and is not due to a size preserving effect alone. Neuromuscular stimulation does not improve muscle volume or patient reported functional outcomes when used for 6 weeks following Achilles tendon surgery.

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Figure 2: Electrodes placed on the calf muscle of one of the clinical staff members.