

Calf Muscle Atrophy and Achilles Tendon Elongation After Acute Achilles Tendon Rupture

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Summary:

Calf muscle atrophy and Achilles tendon elongation seems to be the principal structural explanations for calf muscle strength deficit at short and long term follow up and also explain surgery related greater plantar flexion strength compared conservative treatment after acute Achilles tendon rupture.

Abstract:

Background: Despite good clinical results of surgery and conservative treatment for acute Achilles tendon rupture (ATR), surgery may result in 10-18% better calf muscle strength. However, 12-18% strength deficit compared to the unaffected leg usually remains even in long-term follow up.

Purpose: We aimed to assess whether Achilles tendon elongation and calf muscle volume changes could explain the difference in calf muscle strength between conservative treatment and surgery and side-to-side strength deficit of calf muscle for patients with operatively treated ATR in long term follow-up.

Methods: Group 1; 60 patients with acute ATRs were randomized to surgery or conservative treatment. Conservative treatment and post operative treatments were identical; cast immobilization for one week, followed by functional orthosis for 6 weeks, which allowed full weight bearing after week 1 and active plantar flexion after week 5 post injury. At 18 months, MRI was used to evaluate the volume of calf muscles and the length of the affected Achilles tendon.

Group 2; 60 patients with acute ATRs were randomized to simple end-to-end repair or augmented repair, both with postoperative bracing allowing free active plantar flexion for 3 weeks. After follow-up of =13 years, 55 patients (28 non-augmented, 27 augmented) were re-examined and MRI was used to evaluate the volume of calf muscles, and the length of the Achilles tendons for both legs.

Results: Group 1; At 18 months, the mean differences between healthy and affected soleus muscle volumes were 83.2 cm³ (17.7%) after surgery and 115.5 cm³ (24.8%) after conservative treatments (difference between means: 33.1 cm³, 95% CI: 1.3 to 65.0, $p = 0.042$). Achilles tendon length from calcaneal insertion to soleus muscle MTJ for affected leg was 18.7mm longer for conservative treatment compared operative treatment (95% CI: 8.5 to 28.8, $p < 0.001$). All patients in group 1 suffered up to 21% calf muscle atrophy for affected leg, which was compensated by 11% hypertrophy in flexor hallucis longus (FHL) ($p = 0.001$ in all).

Group 2; At 14 years patients in group 2 suffered up to 12% calf muscle atrophy for affected leg which was compensated by 5.4% hypertrophy in flexor hallucis longus (FHL) ($p = 0.001$ in all). Achilles tendon length from calcaneal insertion to medial gastrocnemius muscle MTJ for affected leg was 12.1mm longer compared healthy tendon (95% CI, 8.6 to 15.6, $p < 0.001$).

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Conclusions: At 18 months ATR conservative treatment with a functional rehabilitation protocol resulted in greater soleus muscle atrophy and 19 mm longer calcaneus to soleus MTJ length to surgical treatment. At 14 years ATR operative treatment resulted up to 12% calf muscle atrophy and 12mm longer Achilles tendon of the affected leg. Calf muscle atrophy in the affected leg was compensated with hypertrophy of the FHL both in short and long term follow-up. Achilles tendon elongation may be the principal structural explanation of calf muscle atrophy and muscle strength deficit at short and long term follow-up after ATR.