Biomechanical Analysis of a Semitendinosus Allograft versus Achilles Turndown for Reconstruction of Large Segmental Achilles Defects

Presenting Author:
Michael Aynardi, MD

Additional Authors:
Lara C. Atwater, MD, Brent G. Parks, MSc, Roshan T. Melvani, MD, Stuart D. Miller, MD

Category: Sports

Keywords: achilles reconstruction, turndown, semitendinosus allograft, biomechanical

Introduction/Purpose: Large segmental Achilles tendon defects present a difficult problem to treating surgeons. Multiple procedures have been utilized to reconstruct these defects, but no studies have evaluated the comparative tensile strength of the various repair methods. Our institution has recently described the use of a dual semitendinosus allograft for Achilles reconstruction. Advantages of this procedure include eliminating donor site morbidity and providing an increased surface area for healing and tendon incorporation. Our study investigated the tensile strength of this novel technique as compared to a standard myofascial turndown procedure. We hypothesized that no differences in biomechanical properties would be found between dual semitendinosus reconstruction and Achilles myofascial turndown reconstruction.

Methods: An 8-cm segmental Achilles defect was created in both specimens of nine matched pair, cadaveric lower extremities. The specimens in each pair were randomly assigned to undergo allograft or turndown reconstruction. The myofacial turndown was secured distally with modified Kessler sutures of 0 braided polyester sutures through bone tunnels in the calcaneus and proximally with multiple interrupted figure-of-8 polyester braid sutures. Semitendinosus grafts were anchored proximally with a Pulvertaft weave and then distally through two bone tunnels within the calcaneus and sutured together around the posterior heel with similar polyester sutures. The foot was disarticulated through the subtalar joint and the Achilles was dissected free of excess soft tissues. The constructs were mounted onto a load frame and differential variable reluctance transducers were applied to the construct. Specimens were preconditioned and then loaded axially. Tensile forces were recorded at 10 mm of displacement and at failure.
**Results:** Semitendinosus allograft failure occurred via calcaneal bone bridge fracture in 8 of 9 specimens, and all myofascial turndowns failed through suture pullout through the fascial tissue at its insertion. None of the specimens failed at the MTS grip sites or via de novo tendon substance rupture. Average ultimate tensile strength of the semitendinosus allograft reconstruction was 290.9±83.2 N compared to that of the turndown repair which was 140.7±43.5 N. At 10 mm of displacement, average tensile strength of the allograft repair was 156.9 ± 29.7 N versus the turndown repair at 101.2 ± 20.0 N. Strength differences between the two repairs were significant at both failure and 10 mm displacement (p < 0.001).

**Conclusion:** Dual semitendinosus allograft reconstruction demonstrates superior tensile strength properties when compared to myofascial turndown in a cadaveric model of large Achilles tendon defects.