Mechanical Analysis of Suture Anchor vs. Tenodesis Screw for FHL Transfer: Implications for Tendon Length Harvested and Specimen Age

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- My disclosure is in the Final AOFAS Program Book.
- I have no potential conflicts with this presentation.
FHL Transfer: Background

- A successful and popular treatment option for chronic Achilles tendonopathy.
- Historically this has been preformed using double and most recently a single incision technique.
- **Single incision technique**
  - **Pros**
    - avoids the risks of extended dissections
    - technically an easier harvest
    - excellent results
  - **Cons**
    - yields smaller grafts which may limit fixation options

- To secure the harvested FHL tendon to the calcaneus, current fixation options include suture anchors and biotenodesis screws.

- To date, no comparative biomechanical study of suture anchor versus biotenodesis screw fixation has been preformed.
- **We investigated the biomechanical profiles of suture anchor and biotenodesis screw fixation as well as the length of FHL autograft needed for each fixation method to achieve acceptable tensioning.**
Methods

- 10 bilateral (n=20), fresh-frozen cadaveric below-knee specimens were provided from The Anatomy Gifts Registry, Hanover, MD.

- Ranged in age from 39–80 years old.
  - The specimens were matched and bilateral.
    - No formula was used to determine laterality with regards to which fixation method was used.
Surgical Technique

- Poster incisions were made over the Achilles tendon. The Achilles tendon was retracted laterally
- Achilles subsheath was incised and the FHL tendon was isolated
- FHL was dissected down into the tarsal tunnel and tenotomized at its most distal accessible point
The length of FHL tendon graft harvested was recorded from the musculotendinous junction to the distal end of the autograft.

The FHL tendon was then tensioned in 10 degrees of plantar flexion, and fixed to the calcaneus using either a Bio-Corkscrew FT 5.5mm x 15mm suture anchor with two #2 Fiberwire sutures or a BioComposite Tenodesis Screw, 5.5 mm x 15 mm (Arthrex, Naples FL).
Methods

- Calcaneus and tendon were excised from the specimen
- Cyclic loading (20 to 60 N, 100 cycles, 4.5 N/s, 5–N preload) was performed
- Followed by a load–to–failure protocol (1.25 mm/s) with a 10kN load cell
- Data were analyzed by repeat measure ANOVA and LSD Post Hoc Test (mean ± SE)
  - Spearmen’s Correlation was performed for effect of age.
**Results**

- Mean length of tendon harvested: **36.15 ± 6.74mm** (range 20 – 51mm).
- Length of tendon needed for suture anchor fixation (**16.8 ± 2.14mm**)
- Length of tendon needed for bio-tenodesis screw fixation (**29.6 ± 2.37 mm**)
  - Significant difference (p=0.002)
- Mean load to failure in the anchor group was comparable to that measured for the bio-tenodesis screw group
  - 171.5± 39.6N screw v 188.8 ± 25.7 N anchor
  - Modes of failure for screw fixation
    - Tunnel pull-out (n=6)
    - Tendon rupture (n=4)
  - Modes of failure for anchor fixation
    - Suture breakage (n=8)
- Fixation stiffness in both groups was comparable
  - (49.67 ± 9.3 N/mm screw vs. 35.4 ± 3.9 N/mm anchor)
- A significant inverse correlation was found with failure load and donor age when all specimens were pooled (rho =−0.49; p<0.05)
  - Biotenodesis screws in younger specimens (<70) resulted in significantly greater failure loads (p<.03)
- The fixation stiffness in both groups was also comparable
  - (49.67 ± 9.3 N/mm screw vs.35.4 ± 3.9 N/mm anchor)
Conclusions

- An adequate amount of FHL tendon can be harvested through a single posterior incision with either fixation option
  - Significantly less FHL tendon length is needed when fixation with a suture anchor is performed
- The fixation strength, load to failure and stiffness was comparable in both groups
  - However, an inverse correlation was found between failure load and donor age with significantly greater failure loads seen in the younger specimens with screw fixation.
