Biomechanical Testing of Distal Achilles Fixation using Suture Anchors: Single Row vs. SutureBridge

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Objective

The purpose of this study is to compare relative strength of repair of the distal Achilles insertion after complete detachment using suture anchors with, and without, the SutureBridge technique.

Methods and Materials

Nine matched pair of frozen cadaveric calcanei with attached Achilles tendons were used for this study (avg. age = 48.1 ± 10.7 years). The calcanei were potted to facilitate loading in the material testing machine. The tendon was split in its midline to a length of 5-7 cm proximal to its insertion. Medial and lateral limbs were elevated off of the calcaneus, and ostectomy of the posterior superior process of the calcaneus was performed (excision of "Haglund's deformity").

Group 1 consisted of repairs using a single row technique using 5.5 mm Bio-Corkscrew FT anchors (AR-8927BNF). Two simple stitches from each anchor were used to fixate the tendon. Group 2 consisted of repairs using a SutureBridge technique (AR-8927BNF and AR-1926B) as seen in Figure 1.

The TekScan Pressure Monitoring System (TekScan, Boston, MA), was placed at the repair site so that contact pressure could be measured.

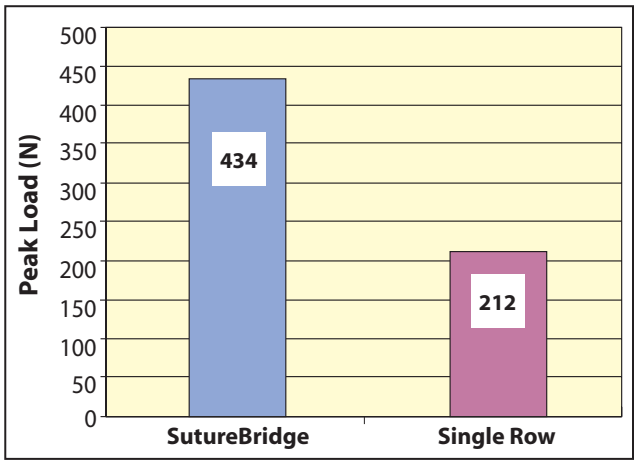
Figure 1: Illustration of the Achilles SutureBridge

Tensile forces were applied to the repair site, via the Achilles tendon at a 30º angle relative to the calcaneus to simulate early heel rise. The constructs were dynamically loaded from 10 to 100 N at 1 Hz for 2000 cycles followed by pull-to-failure.

Results

The cyclic displacement of the SutureBridge constructs was less than that of the single row constructs (1.6 ± 0.7 mm vs. 2.3 ± 0.7 mm respectively); however, the difference was not statistically significant. The greater peak load of SutureBridge constructs was significantly different from that of the single row constructs (434 ± 84 N vs. 212 ± 50 N, $p < 0.001$). The data can be seen graphically in Figure 2. The contact pressure of the SutureBridge construct immediately after the repair was greater than that of the single row constructs (22.8 ± 13.1 kPa vs. 12.4 ± 11.0 kPa); however, the difference was not statistically significant.

Figure 2: Peak load data



Conclusion

The SutureBridge constructs provides greater contact pressure and increased fixation strength compared to that of the single row repair. The improved fixation strength of the SutureBridge construct may lead to more successful clinical outcomes compared to that of the single row repair.