Introduction: The Achillon® Achilles tendon repair system (Integra Life Sciences, Plainsboro, New Jersey) combines the benefits of open repair (visualization of the torn region of tendon and removal of fibrous tissue in older injuries) and percutaneous repair (minimal wound complications) and has excellent clinical results with minimal complications [1, 2]. However, there have been no published studies directly comparing the biomechanics of the Achillon® suture system repair to more commonly used open repair techniques such as the Krakow locking loop [3]. The purpose of our study is therefore to compare the mechanics of the Achillon® Achilles tendon repair system to that of an open Krakow repair (arguably the strongest open repair technique [3]) in human cadavers.

Materials and Methods: The left and right lower limbs of ten (10) human cadavers were randomly split to receive either Achillon repair or open repair utilizing the Krakow locking loop (N=10 cadavers, n=20 ankles). In the Achillon® group, the percutaneous repair was performed on the cadaver Achilles following horizontal transection through the superficial soft tissues and tendon ~ 4 cm proximal to the calcaneal insertion. The incision created when performing the transection is the entry point for subcutaneous placement of the Achillon® device. The device was then used to percutaneously repair the Achilles tendon with No. 1 Ethibond suture as outlined in the manufacturer’s manual. A new device was used for each specimen. In the open repair group, a longitudinal incision (~8 cm long) was made over the Achilles tendon unit beginning at the calcaneal insertion and extending proximally allowing exposure of the tendon for horizontal transection roughly 4 cm proximal to this insertion. The incision is thus longitudinally centered allowing exposure of the tendon for horizontal transection roughly 4 cm proximal to the calcaneal insertion and extending proximally allowing exposure of the tendon for horizontal transection roughly 4 cm proximal to the calcaneal insertion. The incision created when performing the transection is the entry point for subcutaneous placement of the Achillon® device. The device was then used to percutaneously repair the Achilles tendon with No. 1 Ethibond suture as described by Watson et al. was then performed [3]. No supplemental baseball-type stitch or additional fascial reinforcement is added. Therefore, the pull-out strength of the repairs is solely due to the two methods being compared.

Following transection and repair in both study groups, the gastrocnemius muscle-Achilles tendon-calcaneus complex (GACC) was dissected free from the surrounding soft tissues and both study groups were then subjected to the same tissue processing. Proximally, it was separated at the musculotendinous junction. Distally, a portion of the calcaneus large enough to preserve the teno-osseous junction and permit the passage of a Steinmann pin was left attached to the repaired tendon. The soft tissues were not dissected until following the repair so as to simulate the in vivo experience where the surgeon would have to deal with the intervening soft tissues while performing the operative procedure. The aforementioned Steinmann pin was then drilled transversely across the calcaneal block.

Each GACC specimen was placed into a custom clamp on an Instron 8841 device that secured the gastrocnemius muscle proximally and the calcaneus pin distally. After an initial tare load of 0.5 N was applied to initially tension the GACC unit, each specimen was tested in tension to failure at a rate of 25.4 mm/s. From the load-displacement curves, initial linear stiffness (slope of the elastic deformation phase of the test prior to any failure/plastic deformation), load to failure, and work to failure were determined. Data were analyzed in Statistica using both ANOVA and statistical comparisons between the experimental groups were valid even with the exclusion of the 7.63 – 13.79 N/mm) compared to the Achillon technique, with (6.64 ± 7.63 – 13.79 N/mm) compared to the Krakow stitch (7.17 ± 1.44 N/mm, range: 6.13 – 9.97 N/mm). Power analysis of the data with n=7 yielded a value greater than 0.8, indicating that the statistical comparisons between the experimental groups were valid even with the exclusion of the sub-par samples [4].

Discussion: The results indicate that a properly performed Achillon repair can be stronger (higher load to failure) and tougher (higher work to failure) than an open repair using the Krakow locking loop. This may be due to a combination of the increased number of suture strands bridging the gap in the two techniques (Achillon: 6, Krakow: 4) and/or differences in the failure mechanisms. This outcome would support the use of a largely percutaneous technique in lieu of open Achilles repair and its well-documented rate of complications. However, in designing the operative approach to mimic the live surgical experience, the data of 3 out of 10 Achillon-repaired tendons show that the lack of complete exposure can lead to less than perfect seating of the sutures through the Achilles tendon and result in vastly weaker tendon repairs. This caveat reinforces the need for proper training prior to utilizing the device on patients. Differences in Achillon technique may also explain greater post-operative incidences of plantar flexion contracture versus open repair techniques (senior author opinion). Future studies will aim to further characterize the mechanics of Achillon repair to better understand the clinical outcomes and effectiveness of this technique.


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