Interference Screw Fixation with and without SwiveLock® Anchor Backup Fixation

Arthrex Research and Development

Objective

Compare the biomechanical strength characteristics of a tibial ACL interference screw reconstruction with and without a SwiveLock anchor backup fixation.

Methods and Materials

Twenty (20) proximal porcine tibias were potted in fiberglass resin and prepared with 9 mm diameter through holes, using standard ACL reconstruction instrumentation (AR-1900S).

Bovine extensor tendons were used as graft material, and each tail was whipstitched using #2 FiberLoop® suture, as shown in Figure 1. The graft was doubled and passed through the tunnel such that the tendon loop was a 30 mm length above the proximal orifice and the tendon and whipstitched suture tails protruded from the distal orifice.

Figure 1. A bovine extensor tendon graft prepared for insertion into a porcine tibia sample.

All samples were fixated with a 9 mm x 28 mm BioComposite Interference Screw.

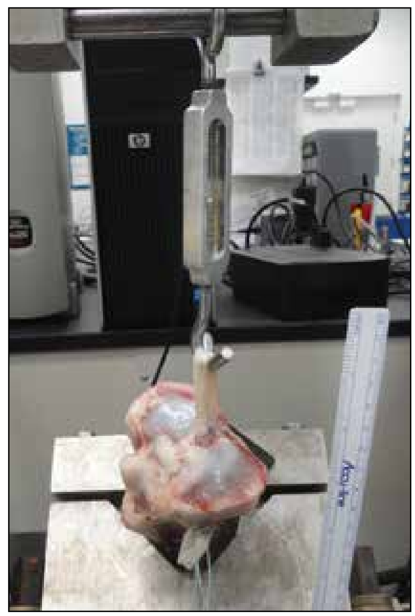
Ten (10) samples were selected at random to receive the additional backup fixation (test group). No further preparations were performed on the other 10 samples (control group).

The whipstitched sutures were held at tension at a point 15 mm-20 mm inferior to the distal tunnel orifice, and the point was marked with the insertion of a 2.4 mm drill tip guide pin, inserted perpendicular to the bone surface. A 4.5 mm cannulated reamer was used to drill a 20 mm deep socket, and the socket was tapped with AR-2324PTB.

All 4 whipstitched suture tails were strung through the closed eyelet of the 4.74 mm SwiveLock anchor, tensioned and fixated into the socket with the suture anchor. The SwiveLock anchors were screwed into the bone until flush with the tibial surface. All samples were prepared by Christopher Verioti, MD from Hanford, California.

Biomechanical testing was performed using an INSTRON 8871 Servohydraulic Materials Testing System (S/N: 8871P7974) with a 5kN load cell (S/N: 40446) secured to the cross-head. A fixed-angle fixture was attached to the testing surface for the purpose of securing the bone samples at an angle, such that the direction of pull was in line with the tibial tunnel. The tendon graft loop was captured by a hook fixture suspended from the crosshead with a clevis and dowel. The sample orientation and fixation is shown in Figure 2.

Figure 2. A porcine tibia sample positioned in the INSTRON machine for biomechanical testing.



A preload of less than 5N was applied to each sample prior to testing. Testing began with 10 cycles between 10N and 50N, at 1Hz, to remove any slack from the system. This precyclic loading was followed by cyclic loading between 50N and 250N, for 500 cycles, at 1Hz.

Load and displacement data were recorded at 500Hz, and the mode of failure was recorded for each sample at the time of testing. Additionally, digital video tracking was used to measure graft displacement at the proximal tunnel orifice during cyclic loading. All outcome measures for both sample groups were compared using t-tests ($\alpha = 0.05$).

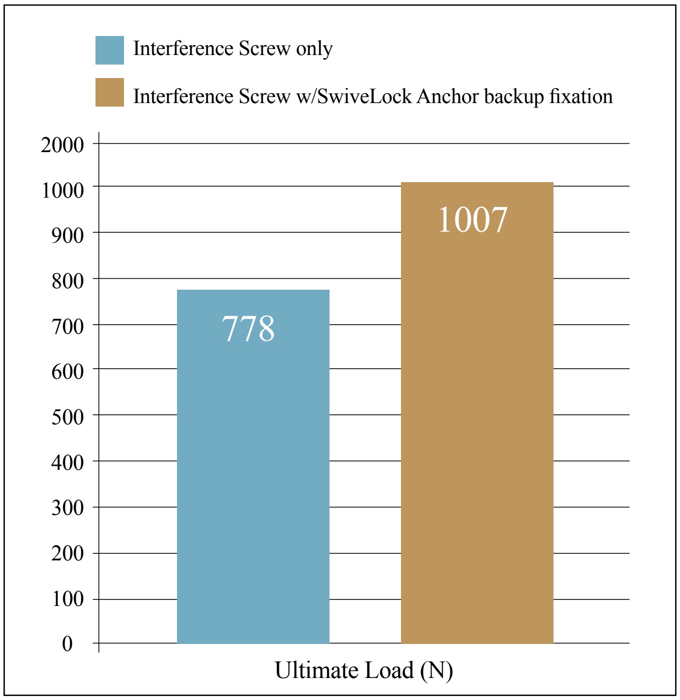
Refer to the 2nd page for the conclusion.

Data Analysis/Conclusions

The samples with the SwiveLock® anchor backup fixation had a significantly higher ultimate load (1007 ± 176N, p-value = 0.005) and yield load (642 ± 172N, p-value = 0.048) than that of the control group (778 ± 139N and 496 ± 133N, respectively). Furthermore, the SwiveLock anchor backup fixation samples had a lower average cyclic displacement (2.1 ± 0.5 mm) than that of the control group (3.3 ± 2.1 mm), although this comparison was not significant (p = 0.185).

Figure 3. Graphical representations of the ultimate and yield loads.

Ultimate Load



Yield Load