

GraftLink® Biomechanical Testing – Tibial Side

Arthrex Research and Development

Objective

Determine the biomechanical fixation properties of the tibial side of an Arthrex GraftLink ACL reconstruction, and compare the results to those of a traditional interference screw reconstruction.

Methods and Materials

Bone mineral density was determined using a DEXA scan for 18 porcine tibias and each was potted in fiberglass resin. Using a random number generator, the tibias were assigned to two sample groups. ACL grafts were created from cadaver hamstring tendons. An example of a GraftLink sample construct, utilizing an ACL TightRope®, is shown in Figure 1, and each was sized between 9 and 10 mm in diameter. The grafts for the interference screw samples were doubled over and sized between 8 and 9 mm in diameter. Porcine tibias were prepared by drilling sockets with 15 mm bone bridges for the GraftLink samples and tunnels for the interference

Figure 1: A GraftLink construct example



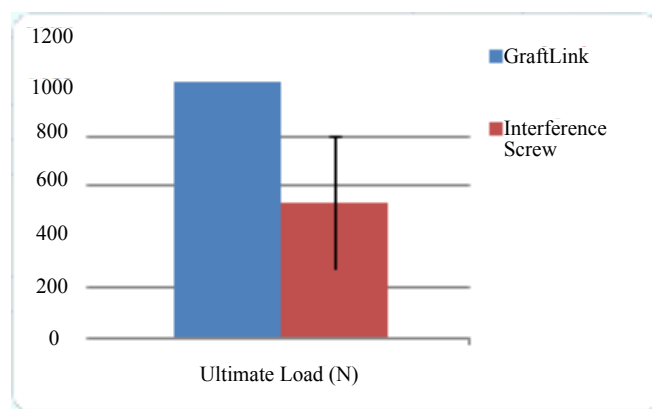
screw samples. Each was sized to match the diameter of the graft being used. The GraftLink samples were secured by pulling the ACL TightRope Button through the 3.5 mm tunnel and tensioning the pull-sutures to draw the GraftLink into the socket. The pull-sutures were tied over the button in a surgeon's knot. The interference screw graft samples were whipstitched, pulled into the tunnels, and fixated with either an 8 mm x 28 mm or 9 mm x 28 mm interference screw, to match the graft and tunnel diameters. Mechanical testing was performed using an INSTRON 8871 Axial Table Top Servohydraulic Testing System (INSTRON, Canton, MA), with a 5kN load cell attached to the cross-head. The

proximal ends of the grafts were attached to a custom inter-digitizing freeze clamp with dry ice. The tibias were held to the testing surface such that the direction of pull was in line with the socket or tunnel. Each sample was precycled from 10 to 50N at 1 Hz for 10 cycles followed by cycling from 50 to 250N at 1 Hz for 500 cycles. Post cycling, pull-to-failure was conducted at 20 mm/min. Load and displacement data were recorded at 500Hz. The ultimate load and the mode-of-failure were recorded for each sample. In addition, digital video tracking was used to determine the displacement of the graft relative to the tibia.

Results

The ultimate load of the GraftLink samples was $1012 \pm 102\text{N}$, and that of the interference screw samples was $537 \pm 266\text{N}$ ($p \leq 0.001$). The cyclic displacement of the GraftLink samples was $2.5 \pm 0.8\text{ mm}$, and that of the interference screw samples was $4.9 \pm 5.9\text{ mm}$ ($p = 0.427$). The difference in the ultimate load is shown graphically in Figure 2. The common mode-of-failure for the GraftLink samples was the ACL TightRope suture breaking ($n=7$ of 9), and the common mode-of-failure for the interference screw samples was the graft slipping past the screw ($n=8$ of 9).

Figure 2: Ultimate load comparison



Conclusion

The biomechanical strength of the GraftLink construct is superior to that of a traditional interference screw.