

Aperture vs. Distal Fixation of Soft Tissue PCL Grafts

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Objective

The purpose of this testing is to compare the fixation strength of aperture and distal fixations of soft tissue PCL grafts in the tibia.

Methods and Materials

Nine human Achilles tendons were fixated to porcine tibias using 8 mm x 20 mm RetroScrews (aperture fixation), and nine more were attached using 9 mm x 28 mm Delta Interference Screws (distal fixation). The tunnel diameter for all graft fixations was 9 mm, and both fixation techniques were backed up by tying the suture ends around titanium Bi-Cortical Posts. Mechanical testing was performed on an Instron (8871 Axial Table Top Servohydraulic) testing system with an attached 5 kN load cell. The position and angle of each specimen was adjusted so that the tensile load was applied at a 45° angle to the tibial plateau. Constructs were preconditioned by cycling at 1 Hz from 10 to 50 N for 10 cycles followed by cyclic loading from 20 to 220 N at 1 Hz for 2000 cycles. Following cycling, the constructs were loaded to 50 N followed by pull to failure at a rate of 1 mm/sec.

Results

The results of the mechanical testing are displayed in Table 1. Using a t-test with a significance of $\alpha = 0.050$, none of the differences between the ultimate and yield loads, the stiffnesses, or any of the cyclic displacements were significant (all $p > 0.053$).

Table 1: Results of the mechanical testing of the aperture and distal fixations.

Fixation	Ultimate Load (N)	Yield Load (N)	Stiffness (N/mm)
Aperture	808 ± 106	615 ± 105	173 ± 29
Distal	889 ± 199	756 ± 173	172 ± 36

Fixation	Cyc Disp at 1 Cycle (mm)	Cyc Disp at 6 Cycles	Cyc Disp at 2000 Cycles
Aperture	3.2 ± 0.7	4.0 ± 0.9	7.5 ± 1.6
Distal	3.2 ± 0.5	4.0 ± 0.7	7.5 ± 1.1

Discussion

Aperture fixation using a RetroScrew offers at least three advantages over the distal fixation using Delta Interference Screws. First, using a RetroScrew allows for similar fixation strength and stiffness while using a smaller screw. Second, it has been shown that synovial fluid proliferation into the graft tunnel is significantly reduced using aperture fixation 6 ± 6 mm deep for the aperture fixations versus 36 ± 13 mm for the distal fixations, as reported by Craig Morgan, M.D., (see "White Papers" at www.arthrex.com). Finally, aperture fixation more closely resembles the anatomical fixation point of the native PCL.

Conclusion

There are no significant differences between the fixation strength, displacement, or stiffness of aperture and distal PCL reconstruction fixation.