

# Affect of Non-Symmetric Shortening of ACL TightRope Implant on Construct Strength

Arthrex Research and Development

## Objective

During shortening of the ACL TightRope implant it is possible to pull the shortening strands non-symmetrically, thus causing the “suture link” of the implant to be off-center. The following testing shows the difference, if any, in implant strength with the suture link in various positions.

## Methods and Materials

Mechanical testing was performed using an INSTRON 8871 Axial Table Top Servohydraulic Dynamic Testing System (INSTRON, Canton, MA) with a 5kN load-cell secured to the cross-head. Each ACL TightRope sample was strung through a 4 mm hole in a metal plate. A hook fixture was used to secure the suture loops to the cross-head. The testing set-up and fixturing is shown in Figure 1. Three samples were oriented so that the suture link was centered on the hook fixture, as shown in Figure 2. Three more samples were oriented such that the suture link was slightly off to one side, as shown in Figure 3, and the remaining three samples were oriented with the suture link severely off-center, as shown in Figure 4. Each sample was precycled between 10 and 50N, at 1 Hz, for 10 cycles to remove slack from the system. Cyclic loading was run between 50 and 250N, at 1 Hz, for 500 cycles. Following cycling, a pull-to-failure was performed at 20 mm/min. Load and displacement data were collected at 500 Hz. The ultimate load, cyclic displacement, and mode of failure were recorded for each sample. A One-Way ANOVA was used to compare differences between the groups.

**Figure 1:** Testing set-up and fixtures



**Figure 2:** Suture link centered on hook fixture



**Figure 3:** Suture link off-center on hook feature



**Figure 4:** Suture link severely off-center



## Results

The results of the mechanical testing are shown in Table 1. For all samples in each group, the mode-of-failure was the suture breaking, either at the splice or at the link. There were no significant differences found between the groups for ultimate load ( $p = 603$ ) or cyclic displacement ( $p = 0.202$ ). If there is non-symmetric shortening of the implant it will not affect construct strength.

**Table 1:** Ultimate load and cyclic displacement results for each sample group

Sample Group	Ultimate Load (N)	Cyclic Displacement (mm)
Centered Link	$897 \pm 152$	$1.1 \pm 0.2$
Off-Center Link	$954 \pm 76$	$1.1 \pm 0.1$
Severely Off-Center Link	$867 \pm 59$	$1.0 \pm 0.1$