

Title of Presentation:

Biomechanical Comparison of Three Femoral Fixation Devices for ACL Reconstruction

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Learning Objectives (After attending this session, the attendee should be able to):

- Understand the biomechanical differences in different ACL femur fixation devices.
- Appreciate the difference in ACL fixation on the lateral cortical surface verses the anterior cortical surface of the femur.

PURPOSE:

The purpose of this study was to evaluate the biomechanical properties of three ACL reconstruction femoral fixation devices in a porcine model using two methods of surgical implantation.

METHODS:

ACL reconstructions with femoral fixation were performed on 48 porcine femurs with one of three femoral fixation devices, Endobutton CL (Endobutton) (Smith & Nephew, Memphis, TN), ToggleLoc with ZipLoop Technology (ToggleLoc) (Biomet Sports Medicine, LLC, Warsaw, Indiana), or EZLoc (Biomet Sports Medicine, LLC, Warsaw, Indiana). In 24 specimens (lateral cortical surface group), the femoral tunnel was drilled from the 10:30 surgical position on the femur out the lateral cortex of the femur. In the remaining 24 specimens (anterior cortical surface group), the tunnel was drilled from the 10:30 position to a standardized anterior femoral surface 5 mm from the lateral cortical edge. For both groups, each fixation device was implanted into 8 femur specimens using an 8mm tendon graft composed of 2-4 porcine extensor tendons. The femurs were secured to an MTS 858 Mini Bionix testing machine (MTS Corp., Eden Prairie, MN) in a custom loading frame that allowed force transfer through the condyles, in line with the bone tunnel. The tendon bundle was pre-tensioned to 49N and secured in a custom cryo-clamp. Cyclic testing was performed from 50N to 450N at 1 Hz for 2000 cycles followed by load to failure testing.

RESULTS:

In the lateral cortical surface group, 100% of the EZLocs, 75% of the ToggleLocs and 62.5% of the Endobuttons failed during cyclic testing. With the standardized anterior cortical surface group, 87.5% of the EZLocs and 37.5% of the ToggleLocs and the Endobuttons failed during cyclic testing. The ToggleLoc exhibited significantly higher 2000 cycle elongation (7.0 +/- 1.0mm, p=0.01) and stiffness (326.3 +/- 9.7 N/mm, p=0.0002) than the Endobutton (5.3 +/- 0.6mm, 258.9 +/- 20.4 N/mm). The Endobutton demonstrated a significantly higher first failure load (1190.9 +/- 150.0 N, p=0.007) than the ToggleLoc (912.6 +/- 82.4N).

CONCLUSIONS:

The Endobutton provided the strongest ACL femoral fixation with the least graft/implant elongation of the implants tested. With double bundle ACL reconstruction or a lateralized single socket femoral tunnel, the surgeon must appreciate that fixation strength is significantly less than a cortical fixation device that is placed on the anterior femoral cortex. In single socket femoral ACL reconstruction with a cortical suspension fixation device, the surgeon should consider tunnel placement exit on the anterior femoral cortex if possible without compromising the anatomic ACL tunnel origin.