Mechanical Evaluation of LoopLoc™ Knotless Implant

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Objective

Determine and compare the strength of LoopLoc knotless implant to #2 Vicryl suture and compare the cyclic displacement of LoopLoc constructs to the clinical failure displacement threshold of 3 mm.
Note: This mechanical strength comparison would be tested within the setting of a hip capsular repair.

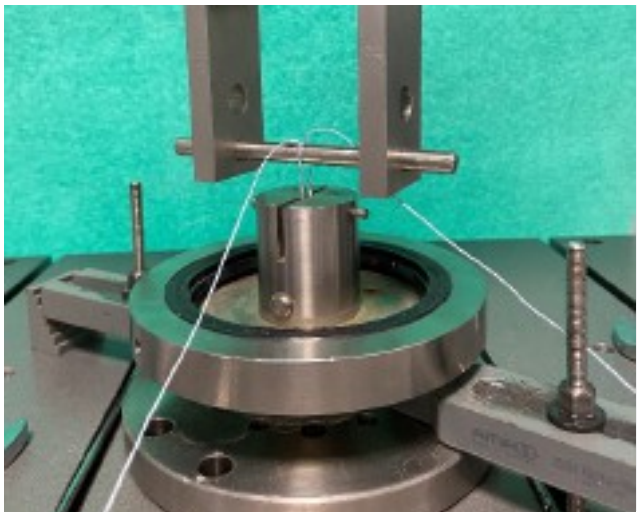
Methods and Materials

The LoopLoc knotless implant was prepared by tensioning the shortening strands to achieve a loop diameter of 19 mm to represent the largest repair size of the hip capsule with 10 mm zona orbicularis thickness and 10 mm insertion offset. Vicryl suture samples were prepared by tying four alternating half-hitches over a 19 mm diameter dowel rod.

Testing was performed using the Instron Materials Testing Machine (Model: E3000). The constructs were axially oriented and secured in the test setup using two rods held by clevises on the actuator and baseplate as seen in Figure 1. The sample was pretensioned to 50 N to simulate intraoperative single-hand tensioning according to Aga et al.[1] The sample was then preloaded to 10 N and pulled to failure at a rate of 3 in/min.

Dynamic Loading
The same procedure of static loading was followed for dynamic loading by pretensioning the sample to 50 N. Then, the sample was cyclically loaded from 10 N to 90 N at 1 Hz for 1000 cycles. After cycling, the sample was pulled to failure at a rate of 1.5 in/min.

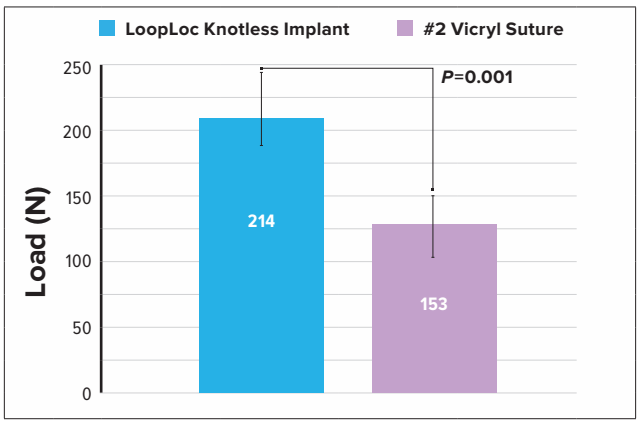
Figure 1. LoopLoc knotless implant prepared in test setup for static and dynamic loading



Results

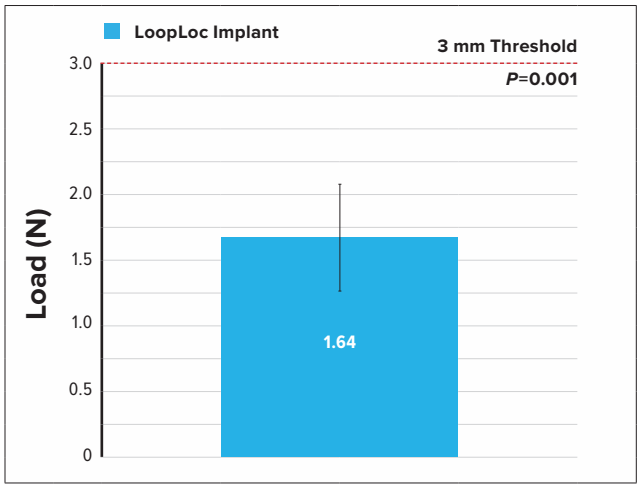
LoopLoc knotless implant's ultimate load results were obtained and compared to data of #2 Vicryl suture. Figure 2 shows the mean ultimate load of LoopLoc knotless implant and #2 Vicryl suture constructs, which were 214 N ± 27 N and 153 N ± 25 N, respectively.[2]

Figure 2. Mean ultimate load of LoopLoc knotless implant versus Vicryl suture with standard deviations noted



LoopLoc knotless implant passed cycling without failure with a mean cyclic displacement of 1.64 mm ± 0.47 mm. This value was compared to the 3 mm limit, known as clinical failure, in Figure 3.[3]

Figure 3. Mean cyclic displacement (with standard deviation shown) of LoopLoc™ knotless implant is significantly lower than the 3 mm threshold



Discussion

The mean ultimate load of LoopLoc knotless implant was significantly higher than the mean ultimate load of #2 Vicryl suture constructs (*P*=0.001).

Additionally, LoopLoc knotless implant's average cyclic displacement was significantly lower than the 3 mm limit (*P*=0.001). Therefore, LoopLoc knotless implant has superior mechanical strength when compared to #2 Vicryl suture and has displacement values significantly lower than the 3 mm threshold.

References

1. Aga C, Rasmussen MT, Smith SD, et al. Biomechanical comparison of interference screws and combination screw and sheath devices for soft tissue anterior cruciate ligament reconstruction on the tibial side. *Am J Sports Med.* 2013;41(4):841-848. doi:10.1177/0363546512474968
2. Arthrex, Inc. Data on file (APT 05180). Naples, FL; 2021.
3. Burkhart SS, Wirth MA, Simonich M, Salem D, Lanctot D, Athanasiou K. Knot security in simple sliding knots and its relationship to rotator cuff repair: how secure must the knot be? *Arthroscopy.* 2000;16(2):202-207. doi:10.1016/s0749-8063(00)90037-9

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