

# Biomechanical Evaluation of the JuggerKnot™ Long Soft Anchor in Cadaver Bone

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August 2013

## Introduction

The JuggerKnot™ Long Soft Anchor builds upon the heritage of the existing all-suture JuggerKnot™ Soft Anchor. The instrumentation designed for this anchor assists with procedures requiring longer length including hip acetabular labral repairs. The benefits of this anchor include the size, strength and all-suture design. The results of this study demonstrated the biomechanical cyclic displacement and average ultimate load between four different product options (noted in the methods section) for a hip labral repair.

## Materials and Methods

Four different anchors were tested for cyclic displacement and maximum load to failure in cadaver pelvis bones: The JuggerKnot™ Long Soft Anchor with #1 and #2 MaxBraid™ Sutures (Biomet Sports Medicine, Warsaw, IN), 3.5 mm Biocomposite PushLock® Knotless Anchors (Arthrex, Inc., Naples, FL), and 2.9 mm Bioabsorbable Bioraptor® Suture Anchors (Smith & Nephew, Inc., Cordova, TN). Four of each anchor was tested, but five Smith and Nephew anchors were tested due to the placement of the anchor in a wrong quadrant. An anchor was tested in each of the four quadrants of the acetabular rim. However, with the Bioraptor® anchor, one anchor was placed in the wrong quadrant and thus an additional anchor had to be placed. All anchors were placed according to the manufacturer's surgical technique.

Once placed, the anchors were tested for cyclic load followed by load to failure. The constructs were preloaded to 10N at 1N/s and were held at 10N for 5 seconds. After preloading, the constructs were cycled from 10 to 60N at 1 Hz for 500 cycles. After cycling, those anchors that survived the cycling were subjected to a single pull to failure conducted at 1.18in/min. The test location was Warsaw, IN. Cyclic testing and load to failure testing were performed on a Shore Western Load Frame (GPP 1257-9/ Serial Number 234176A).

Following testing, the surface area of each drill hole was compared.

## Results

Cyclic displacement data indicated the JuggerKnot™ Long Soft Anchor with #1 suture and JuggerKnot™ Long Soft Anchor with #2 suture had the lowest average cyclic displacement of all anchors compared (Figure 1). The results of the displacement for each anchor was as follows:

- JuggerKnot™ Long Soft Anchor with #1 – 37.80 lbs.
- JuggerKnot™ Long Soft Anchor with #2 – 39.19 lbs.
- Bioraptor™ Anchor – 44.99 lbs.
- PushLock® Anchor – 37.72 lbs.

All anchors survived cyclic loading and were pulled to failure. Ultimate load testing found no statistically significant difference between any of the anchors using a Tukey test at 95% confidence.

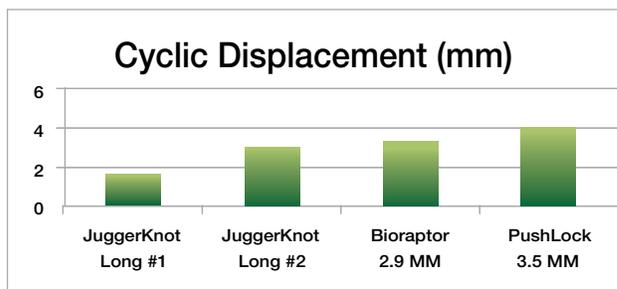
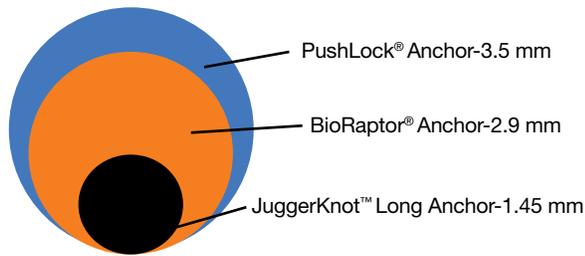


Figure 1

## Discussion

As can be seen in Figure 1, the average cyclic displacement for the JuggerKnot™ Long Soft Anchor with #1 MaxBraid™ suture and the JuggerKnot™ Long Soft Anchor with #2 MaxBraid™ suture had the lowest cyclic displacement of all anchors tested. All anchors tested displaced less than 5 mm. Cyclic displacement above 5 mm is considered a clinical failure in a glenoid labral repair model.<sup>1</sup> No data was found to suggest how much displacement would constitute a clinical failure in the hip labral repair.



**Figure 2**

In load to failure testing, all anchors were comparable, falling between 35 and 44 lbs. Similar testing by Barber *et al* showed average failure loads of suture anchors tested in a hip model between 154N – 225N (34.6 – 57.3 lbs)<sup>1</sup>. In our model, as well as the Barber paper, no statistically significant difference was found among any of the anchors tested.

As shown in Figure 2, the JuggerKnot™ Long Soft Anchor required 73% less surface area when compared to competitive anchors; therefore, allowing more anchors to be placed in a given area with additional points of fixation during labral repair.

## Conclusion

The JuggerKnot™ Long Soft Anchors demonstrated lower cyclic displacement and equivalent pullout strength compared with larger sized suture anchors. Conserving bone and the ability to place the anchor as close as possible to the articular surface.

## References

1. Ruiz-Suarez, Michell, Jorge Aziz-Jacobo, and F. Alan Barber. "Cyclic Load Testing and Ultimate Failure Strength of Suture Anchors in the Acetabular Rim." *Arthroscopy: The Journal of Arthroscopic & Related Surgery* 26.6 (2010): 762-68. Print.

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