A Biomechanical Study to Compare an All-Suture Anchor to a Composite Suture Anchor in Sheep Cadaver Humeri

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Statement of Purpose: Suture anchors are used to reattach damaged ligaments and tendons in the shoulder, hand, wrist, thumb and ankle. Classic solid suture anchors are limited in the larger volume of bone required for proper insertion, may be ineffective and/or damaged if improperly placed are difficult or impossible to revise, may require additional steps on insertion, may have lower pull out strengths, and can obscure imaging studies post-operatively. All-soft suture anchors are an acceptable alternative that address the limitations of classic solid suture anchor implants[1]. The purpose of our investigation was to evaluate performance of an all-soft suture anchor in comparison with a classic solid suture anchor in an in vitro infraspinatus tendon repair model.

Methods: Three matched pairs of fresh skeletally mature sheep shoulders were harvested and dissected down to the humerus with all soft tissue and ligamentous attachment removed. Four defects spaced approximately10 mm apart were created in the proximal humerus using each manufacturer's drill. Arthrex 2.4mm BioComposite SutureTak® Suture anchors, Stryker ICONIX 1™ (one suture), or Stryker ICONIX 2™ (two sutures) were inserted and secured to each designated paired humeri using the appropriate inserter prior to testing. The suture ends were aligned and a loop was created from the suture end of the anchor. Each suture anchor was tested individually. The suture anchor loop was attached to the cross-arm of the servo-hydraulic testing machine (Model 858 Mini Bionix II, MTS Corp., Eden Prairie, MN). The humerus was secured to the plate of the MTS machine. With the anchor tunnel straight with respect to the direction of pull, the test system was pre-tensioned to approximately 10 N to remove laxity from the system. The suture anchor was then pulled to failure at a speed of 25 mm/sec. Failure was characterized when the mechanical integrity of the sample was lost, usually indicated by a substantial decrease in force. Kruskal-Wallis ANOVA non parametric analysis and one-way ANOVA were applied with determine significant differences assumed at $p<0.05$.

Results / Discussion: All anchors failed by pullout except one ICONIX 1™ anchor broke at the knot. For maximum load both ICONIX anchors were significantly stronger than the SutureTak. For load at 2mm and 3mm displacement, ICONIX2™ was significantly stronger than ICONIX1™ and trended toward being significantly stronger than the SutureTak ($p=0.08$ and $p=0.09$ respectively).

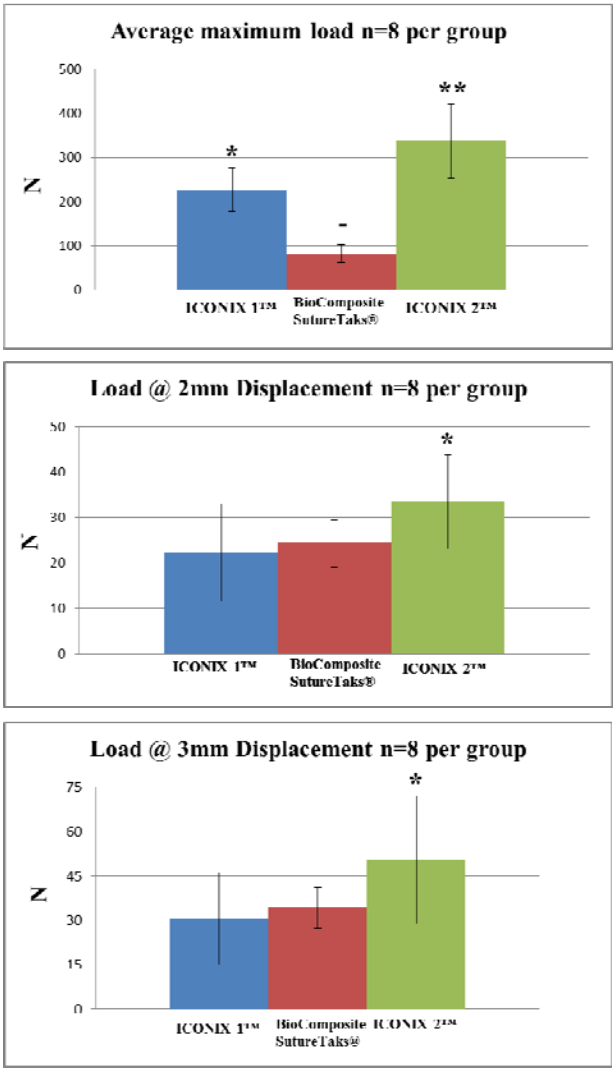

Figure 1. Average ± standard deviation.

Conclusions: Proper placement and deployment of suture anchors, in the compact cancellous bone regions of the humeri, were critical for anchor comparison. The all-suture anchors were shown to be stronger than the more traditional composite anchor in this model. The double loaded all-suture anchor was stronger than the single loaded.

References:

1. Biomechanical Evaluation of Classic Solid and Novel All-Soft Suture Anchors for Glenoid Labral Repair. Mazzocca A et al. Arthroscopy, Vol 28, No 5 2012.