INTRODUCTION:
Arthroscopic biceps tenodesis has become a popular alternative to open keyhole fixation to minimize risks associated with bony defects and hardware. Arthroscopic techniques include soft tissue fixation to the transverse humeral ligament and anchor fixation to the bicipital groove; however, there is little biomechanical data on the initial strength of these repairs. The objective of this study was to evaluate the biomechanical properties of these two arthroscopic biceps tenodesis techniques.

MATERIALS AND METHODS:
Twelve fresh frozen human cadaveric shoulders (mean age=50±6 years) were dissected to isolate the rotator cuff interval. The tendon was then clamped in a custom sinusoidal clamp and attached to the crosshead of a materials testing machine (Adelaide Testing Machines, Model TTS-25 Series, Toronto, Canada). The humerus was potted in a cylindrical mold of epoxy putty and mounted to the base of the testing machine. Superior displacement of the tendon was moved parallel to the long axis of the humeral shaft.

After mounting, an initial preload of 5N was achieved to pretension the isolated tendon (Figure 1). Two biceps tenodesis repair techniques were evaluated in this study: Suture Anchor and Percutaneous Intra-articular Trans-Tendon (PITT) Technique. The suture anchor biceps tenodesis consisted of implanting two bio-resorbable suture anchors (AnchorSew, USS Sports Medicine, North Haven, CT) in the bicipital groove 6 mm apart. Each anchor was loaded with a continuous sliding suture. Each end of the suture was passed through the biceps tendon with 2mm of separation (ArthroSew, USS Sports Medicine, North Haven, CT). Then one end of each arm from each anchor suture was attached to adjoining anchor and tied down with an arthroscopic Nicky’s knot to form a criss-cross fixation pattern. The PITT technique consisted of using a spinal needle to pass two strands (#2 Surgidac and #2 Ti-Cron) through the biceps tendon and transverse humeral ligament and fixed in a criss-cross pattern as previously mentioned.

A load-to-failure protocol was then performed at a speed of 1.25 mm/sec. The structural properties of the repaired tendon including ultimate load (N) and stiffness (N/mm) were derived from the load-elongation curve and the mode of failure was recorded. A Student’s paired T-test was used to statistically compare the structural properties and footprint restoration of the repaired rotator cuff tendon complexes with a significance set at p<0.05.

RESULTS:
Suture anchor and PITT techniques had ultimate loads of 161±40N and 147±35N and stiffness of 19.6±7.0N/mm and 14.4±2.0N/mm, with no statistical difference between techniques, respectively (p>0.05); however, a power analysis determined that more specimens could yield a difference for stiffness (Figure 2). Both repairs had typical load-displacement curves into the linear region and footprints of the repaired rotator cuff tendon complexes with a significance set at p<0.05.

DISCUSSION:
Suture anchor and PITT techniques exhibited satisfactory initial strength with no statistical difference for ultimate load and a trend toward significance for stiffness between the two groups. These findings along with the consistent pullout of the suture through the tendon during failure suggests that the most important factor for initial strength is not dependent on the attachment site but dependent on the quality of the biceps tendon. This may be important when considering post-operative rehabilitation. Since each fixation is secured to separate entities, the quality of bone and tendon may dictate which procedure is more appropriate during surgery.

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