Biomechanical comparison of JuggerKnot™ Soft Anchor and GRYPHON™ BR in a human cadaver model

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Objective

The purpose of this study was to compare the migration during cyclic loading and the pullout failure and associated displacement of the Biomet JuggerKnot™ and the DePuy Mitek GRYPHON™ BR anchors in a human cadaveric model. We hypothesized that the fixation constructs would perform similarly in terms of the ultimate failure load, however, that the GRYPHON anchors would provide more rigid fixation during cyclic loading and therefore undergo less migration compared to the JuggerKnot.

Methods

Two pairs of human cadaveric scapulae were prepared for bone anchor insertion along the glenoid rim. DEXA scans of the specimens confirmed that neither of the donors had bone metastases or generalized bone disease. Six insertion sites were identified on the glenoid rim that were equally-spaced apart and the scapulae were potted in a urethane potting compound. Each location received a single fixation construct, alternating between the GRYPHON BR and JuggerKnot devices (Figure 1). The opposite configuration was used for the contralateral glenoid. All devices were tested with a single high-strength suture (provided with the anchor); a suture loop was created around a metal mandrel and secured with a surgeon's knot plus four alternating half hitches. After all devices had been successfully inserted, the glenoid specimens were rigidly fixed to a mechanical testing machine such that anchors were aligned axially with the loading axis. The suture was looped around a hook attached to the crosshead and the constructs were preloaded for five seconds at 10 N, and then cycled from 10 N to 45 N at 1 Hz for 200 cycles [Tashjian et al. *Arthroscopy* 2007]. For anchors that did not fail in 200 cycles, a monotonic pull test was performed by applying a tensile load at 4.23 mm/sec. Failure was defined at the point when the fixation construct displaced by 5 mm [Barber et al. *Arthroscopy* 2008]. Metrics of interest included the number of cycles to achieve 3 and 5 mm of slippage, actuator displacement at 200 cycles, and the load required to induce anchor failure. The mode of failure for each anchor test was also noted.

Results

There was not a statistically significant difference in the maximum loads to failure (119.6 ± 32.1 N for Gryphon and 139.4 ± 35.4 N for JuggerKnot) ($p=0.166$). However, the Gryphon BR anchors migrated significantly less during cyclic loading (1.41 ± 0.27 mm vs. 5.82 ± 4.1 mm; $p=0.003$). This was evident in the number of cycles to reach 3 mm displacement, in which Gryphon did not reach this level of migration in 11/12 samples (92%), but only 3/12 JuggerKnot anchors (25%) made it to 200 cycles without 3 mm of displacement. Of the JuggerKnot devices that displaced 3 mm or more during cyclic loading, the average number of cycles that it took to get to this level was only 18 cycles. The percentage of devices that exhibited less than 5 mm of displacement during cyclic testing was 92% for GRYPHON and 50% for JuggerKnot.

Conclusion

The two devices tested do not appear to have differences in their holding strength, but the GRYPHON BR anchor migrates significantly less than Juggerknot during cyclic loading.

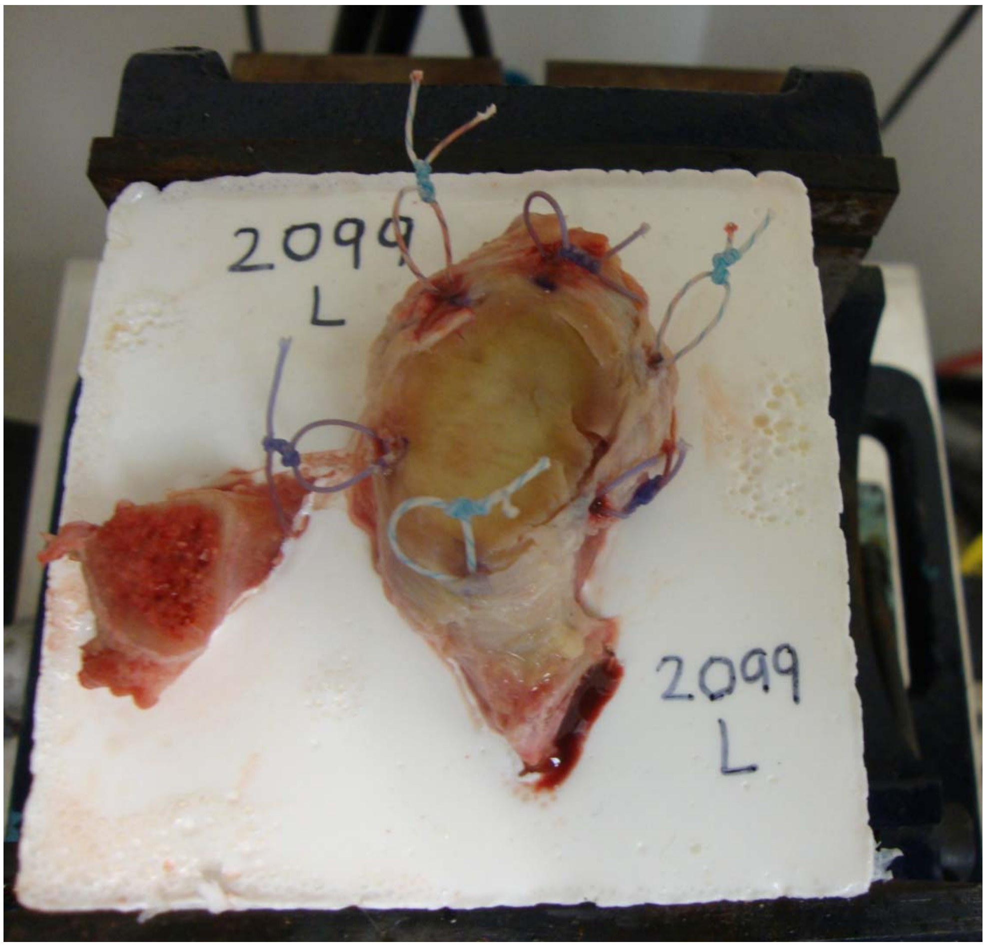

Figure 1: Insertion locations on glenoid rim

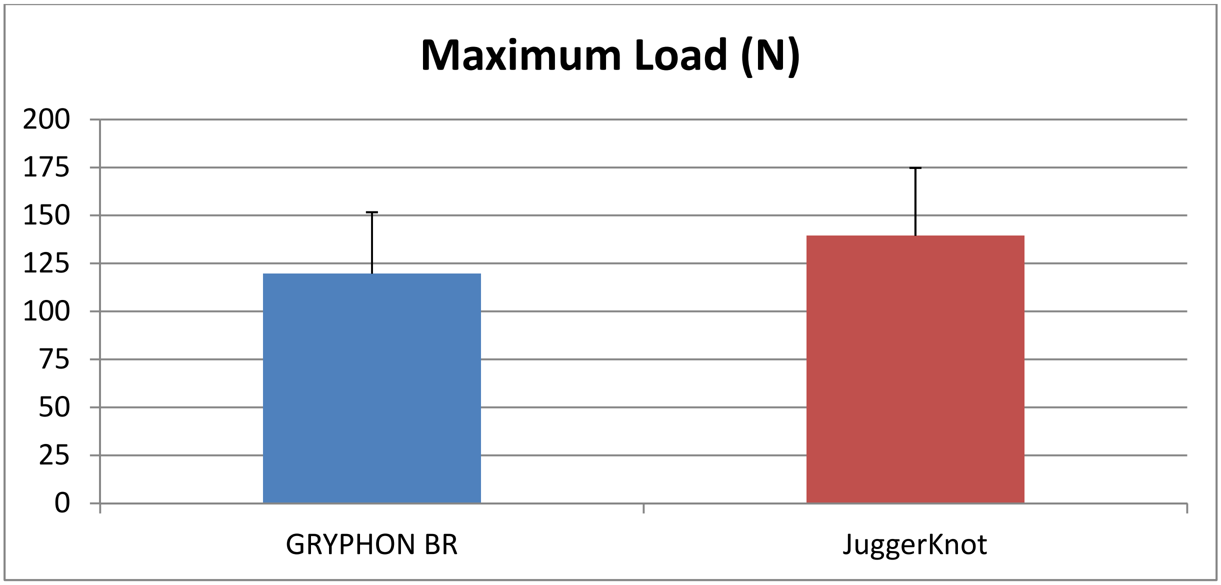

Figure 2: Comparison of maximum load data showing no statistically significant difference between devices (p=0.116)

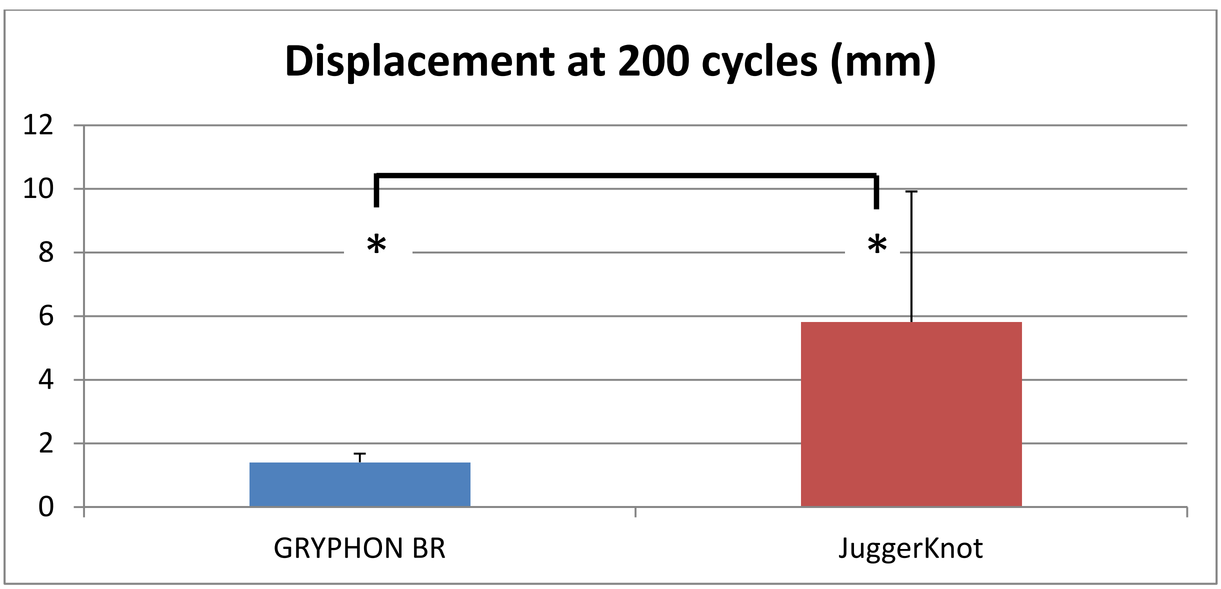

Figure 3: Comparison of cyclic displacement data showing GRYPHON migrating significantly less than JuggerKnot (p=0.003)