Analysis of Glenoid Inter-anchor Distance with an All-Suture Anchor System

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OBJECTIVES

Arthroscopic shoulder stabilization using suture anchors are commonly used techniques. More recently developed all-suture systems employ smaller diameter anchors, which increase repair contact area and allow greater placement density on narrow surfaces such as the glenoid. Our goal is investigate the strength characteristics of various inter-anchor distances in a human glenoid model.

METHODS

Twelve fresh-frozen human cadaveric glenoids were potted after the labrum was excised. The glenoids were then implanted with 1.4 mm all-suture anchors (JuggerKnot Soft Anchors, Zimmer Biomet, Warsaw, IN) at varying inter-anchor distances. Anchors were implanted adjacent to one another or at 2 mm, 3 mm, or 5 mm distances using a template with pre-drilled holes. The glenoids were then underwent single cycle pullout testing using a test frame (Instron 8521, Instron Inc., Norwood, MA). A 5N preload was applied to the construct and the actuator was driven away from the shoulder at a rate of 12.5 mm/s. Force and displacement were collected from the test frame actuator at a rate of 500 Hz. The primary outcomes were failure strength, stiffness, and ultimate strength. Stiffness was calculated from the initial linear region of the force displacement curve. Failure strength was defined as the first local maximum inflection point in the force displacement curve. Ultimate strength was taken to be the maximum overall load observed.

RESULTS

During load to fail testing, all but three of the specimens had both anchors pull out of the glenoid. The other mode of failure included one or both of the sutures failing. Stiffness was 13.52 ± 3.8, 17.97 ± 5.02, 17.59 ± 4.65 and 18.95 ± 4.67 N/mm for the adjacent, 2 mm, 3 mm and 5 mm treatment groups. The adjacent group had a significantly lower stiffness compared to the other treatment groups. Failure strength was 48.68 ± 20.64, 76.16 ± 23.78, 73.19 ± 35.83 and 87.04 ± 34.67 N for the adjacent, 2 mm, 3 mm and 5 mm treatment groups. The adjacent group had a significantly lower failure strength compared to the other treatment groups. Ultimate strength was also measured to be 190.59 ± 140.93, 268.7 ± 115.1, 283.23 ± 118.43, and 291.28 ± 118.24 for the ADJ, 2mm, 3mm and 5mm treatment groups. The adjacently spaced anchors had a trend towards lower ultimate strength though there was no statistically significant difference.

CONCLUSIONS

These data provide biomechanical evidence that in the glenoid, small diameter all-suture anchors may be implanted as close as 2 mm to one another without significantly decreasing their strength characteristics.

REFERENCES