

Biomechanical Comparison of SutureBridge and Single Row Rotator Cuff Repairs

Arthrex Research and Development

Purpose

The purpose of this study was to elucidate the biomechanical advantages of the SutureBridge rotator cuff repair when compared to a standard single row repair using two Bio-Corkscrew FT anchors and four simple stitches. To elucidate the advantages of the SutureBridge repair, three biomechanical tests were conducted:

- 1) Determination of gap displacement and load to failure
- 2) Comparison of footprint contact area and pressure
- 3) Comparison of footprint displacement during internal/external rotation

Objective 1

To compare the gap displacement and load to failure of SutureBridge vs single row

Methods and Materials

A matched-pair human cadaver study (n=6 in both groups) was conducted to compare the gap displacement and load-to-failure of SutureBridge rotator cuff repairs to a single row repair. Once the supraspinatus was reattached to the humerus, the humerus was secured in a material testing machine. Tensile loads were applied to the tendon at a 135° angle relative to the long axis of the humerus to simulate physiological loading. The repaired tendon was cycled between 10 and 100 N for 500 cycles followed by pull-to-failure at 33 mm/sec.

Results

The gap formation of the SutureBridge repair was statistically less ($p < 0.05$) compared to that of the single row repair (1.1 ± 0.5 mm vs. 2.4 ± 0.3 mm) as shown in Figure 1. Although not statistically significant, the load-to-failure of the SutureBridge repair was 23% higher than that of the single row repair (460 ± 80 N vs. 373 ± 69 N) as shown in Figure 2.

Figure 1.

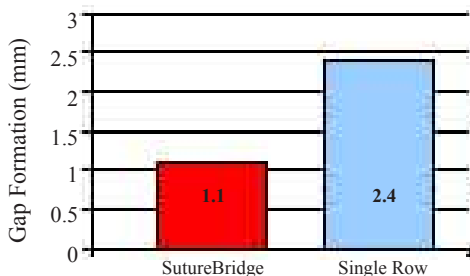
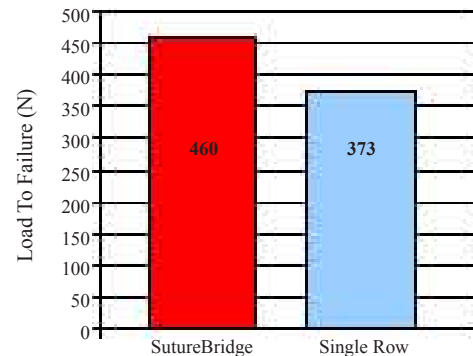


Figure 2.



Objective 2

To compare the footprint contact area and pressure of SutureBridge vs single row

Methods and Materials

Human rotator cuff tissue was secured to Sawbones humerus models using either a SutureBridge or single row repair. Ultra Low Pressurex® Pressure Indicating Film (Sensor Products Inc., East Hanover, NJ) with a pressure range from 190 kPa to 590 kPa was used to compare the footprint contact pressure and area of the two repairs. Sawbones humerus models were used instead of cadaver humeri in order to minimize the effect of different footprint geometry between specimens. Three constructs in each group were tested.

Results

The average contact pressure in the footprint of the SutureBridge repair was 68% higher than that of the Single Row repair (470 ± 22 kPa vs. 280 ± 110 kPa). The average contact area of the SutureBridge repair was 98% greater than that of the Single Row repair (103 ± 18 mm² vs. 52 ± 19 mm²). Representative photos of the pressure sensitive film can be seen in Figures 3 and 4. The data is presented graphically in Figures 5 and 6.

Figure 3: Pressure film sample from the SutureBridge repair



Figure 4: Pressure film sample from the single row repair



Figure 5.

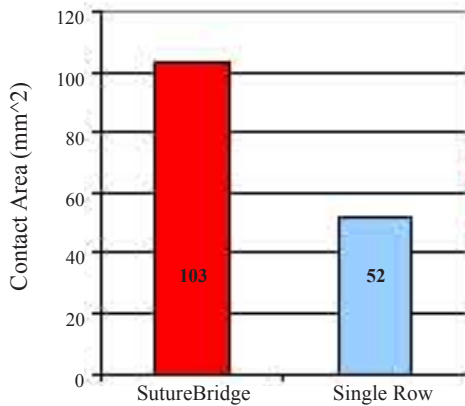
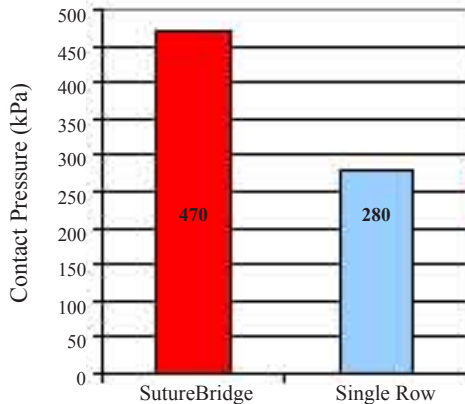


Figure 6.



Objective 3

To compare the footprint displacement during internal/external rotation of SutureBridge vs single row

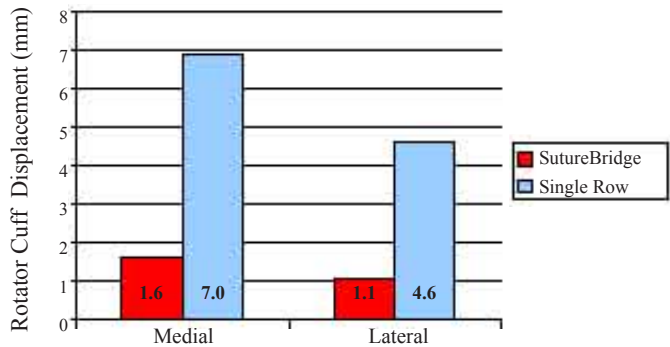
Methods and Materials

Matched pairs of human cadaver shoulders (n=3 in both groups) were stripped of all soft tissue except the rotator cuff tissue and their attachment points on the scapula and humerus. The supraspinatus was transected from the fossa and humerus then reattached to the humerus using either a SutureBridge or single row repair. The shoulder constructs were placed in a custom test fixture that allowed the construct to be cycled between 60° of internal and 60° of external rotation while using optical tracking equipment to quantify the displacement of the tendon on the footprint.

Results

The footprint motion in the medial portion of the footprint of the SutureBridge repair was 77% lower than that of the single row repair (1.6 ± 0.5 mm vs. 7.0 ± 2.8 mm). The footprint motion in the lateral portion of the footprint of the SutureBridge repair was 76% lower than that of the single row repair (1.1 ± 0.2 mm vs. 4.6 ± 1.7 mm). The data is presented graphically in Figure 7.

Figure 7.



Objective Conclusions

The biomechanical performance of the SutureBridge rotator cuff repair is superior to that of the single row repair. The SutureBridge repair has less gap formation and higher load to failure during tensile testing. The contact pressure and contact area on the native footprint of the SutureBridge repair was greater than that of the single row. In addition, footprint motion during internal/external rotation was less in the SutureBridge repair compared to that of the single row repair. The superior biomechanical performance of the SutureBridge repair may indicate a more stable repair.