MIDWEST ORTHOPAEDICS AT RUSH

Early Postoperative Increase of IL-1a in Synovial Fluid Correlates with Worse Short-Term Patient-Reported Outcomes after Cartilage Transplantation in the Knee

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BACKGROUND

- Full-thickness focal chondral defects (FCDs) may present in isolation or in conjunction with other pathologies to the knee, commonly among the young, athletic population
- Due to its poor vascularity and limited proliferative capacity of chondrocytes, damage to articular cartilage generally leads to further degenerative changes and progression of pain and disability
- Protein biomarkers in synovial fluid have been introduced as a method to further characterize the potential source of symptoms associated with intra-articular pathologies

PURPOSE

The purpose of this study was to (1) describe the longitudinal pro-inflammatory proteomic profile of synovial fluid after cartilage transplantation with either osteochondral allograft (OCA) or autochondrocyte implantation (ACI) up to 1 year postoperatively and (2) analyze correlations between changes in cytokine concentrations and postoperative patient-reported outcomes (PROs)

HYPOTHESIS

- The increase in certain cytokines will correlate with worse PROs

METHODS

Patient Selection

- Patients undergoing cartilage restoration procedures with OCA, ACI, MAT, or Mfx
- Patients aged 18-50
- Exclusion: Lawrence grade 3+ on pre-op x-ray and history of inflammatory arthropathy

Specimen Preparation

- The humeral head was disarticulated from the glenoid, and artificial Bankart lesions were created with a scalpel on the AI quadrant of the labrum
- Specimen were then potted in acrylic cement, ensuring as much scapular spine was embedded in the acrylic as possible, with the glenoid fossa 1 cm above the PVC pipe
- 3 anchors of the same type were placed at the 3:30, 4:30, and 5:30 labral positions. Sutures were passed through 1 cm of tissue and knotted anchors were tied with 5 square knots

Mechanical Testing

- Anchors were tested simultaneously as one construct by pulling the capsular tissue connected to the AI quadrant, pulling perpendicular from the glenoid
- Preload testing (5N for 2 min) was followed by cyclic loading (5-25 N, 100 cycles) then by load-to-failure testing (15mm/min).
- Mechanical testing variables and failure mechanism were recorded (bone failure, capsule failure, or implant failure)

RESULTS

Anchor Group	SB Knotless	SB Knotted	HB Knotless	P-Value
Maximum Load to Failure (N)	309.7 ± 125.6	226.4 ± 34.8	256.5 ± 90.5	0.25
Stiffness (N/mm)	31.9 ± 8.5	23.0 ± 5.2	34.1 ± 16.5	0.13
Energy to Peak Load (N-mm)	3352.2 ± 1893.2	2260.9 ± 1065.8	2436.7 ± 1569.0	0.40
Cyclic Creep (mm)	2.8 ± 1.2	3.1 ± 1.8	2.2 ± 0.9	0.44
Cyclic Elongation (mm)	1.1 ± 0.5	1.2 ± 0.7	0.80 ± 0.4	0.40
Elongation Amplitude (mm)	0.85 ± 0.19	0.84 ± 0.17	0.85 ± 0.18	0.99
1st Cycle Excursion (mm)	1.7 ± 0.8	2.0 ± 1.3	1.4 ± 0.5	0.52
Extrusion at Max Load (mm)	19.1 ± 6.6	18.5 ± 8.0	13.8 ± 4.8	0.28

Figure 1. Results of mechanical testing. Data are reported as means ± standard deviation

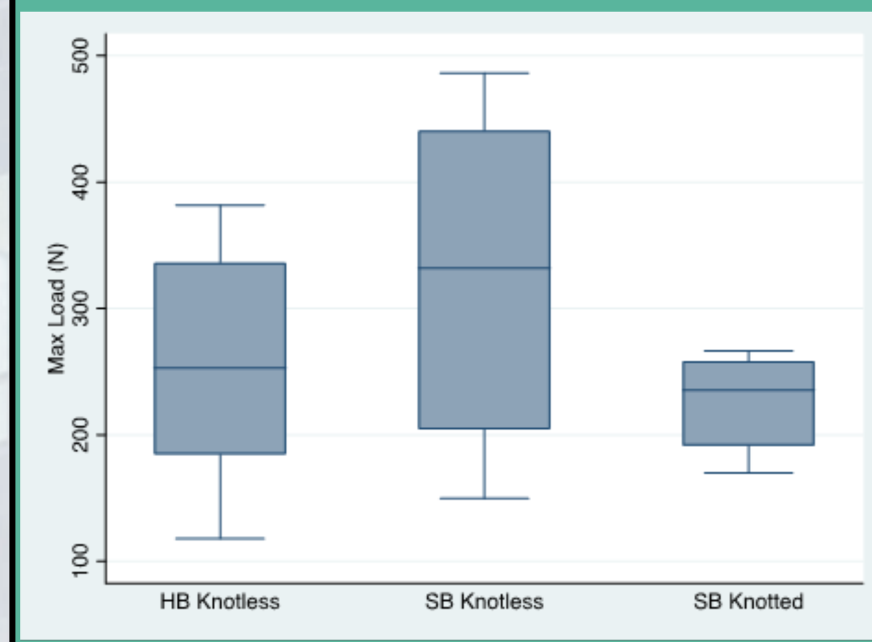

Figure 2. Boxplot demonstrating max load to failure by anchor type

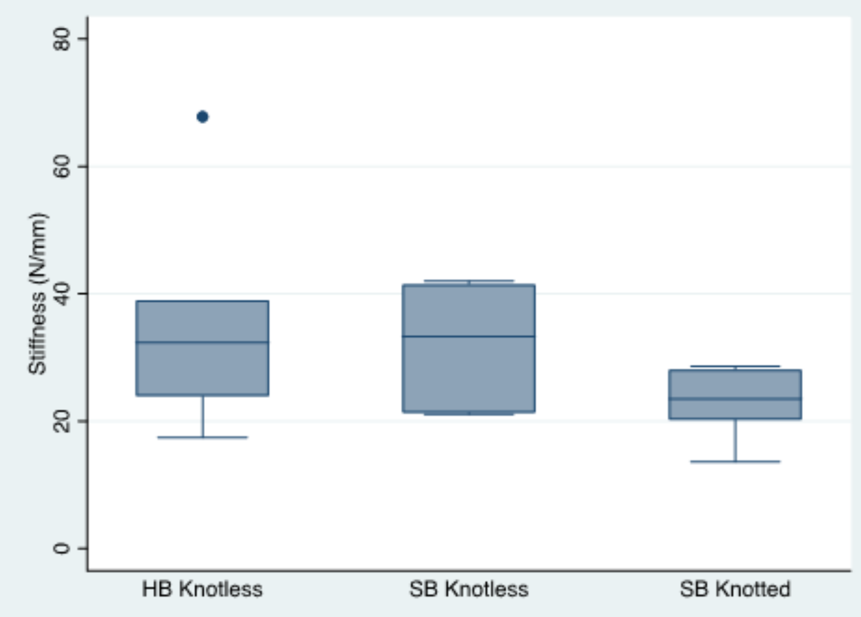

Figure 3. Boxplot demonstrating construct stiffness by anchor type

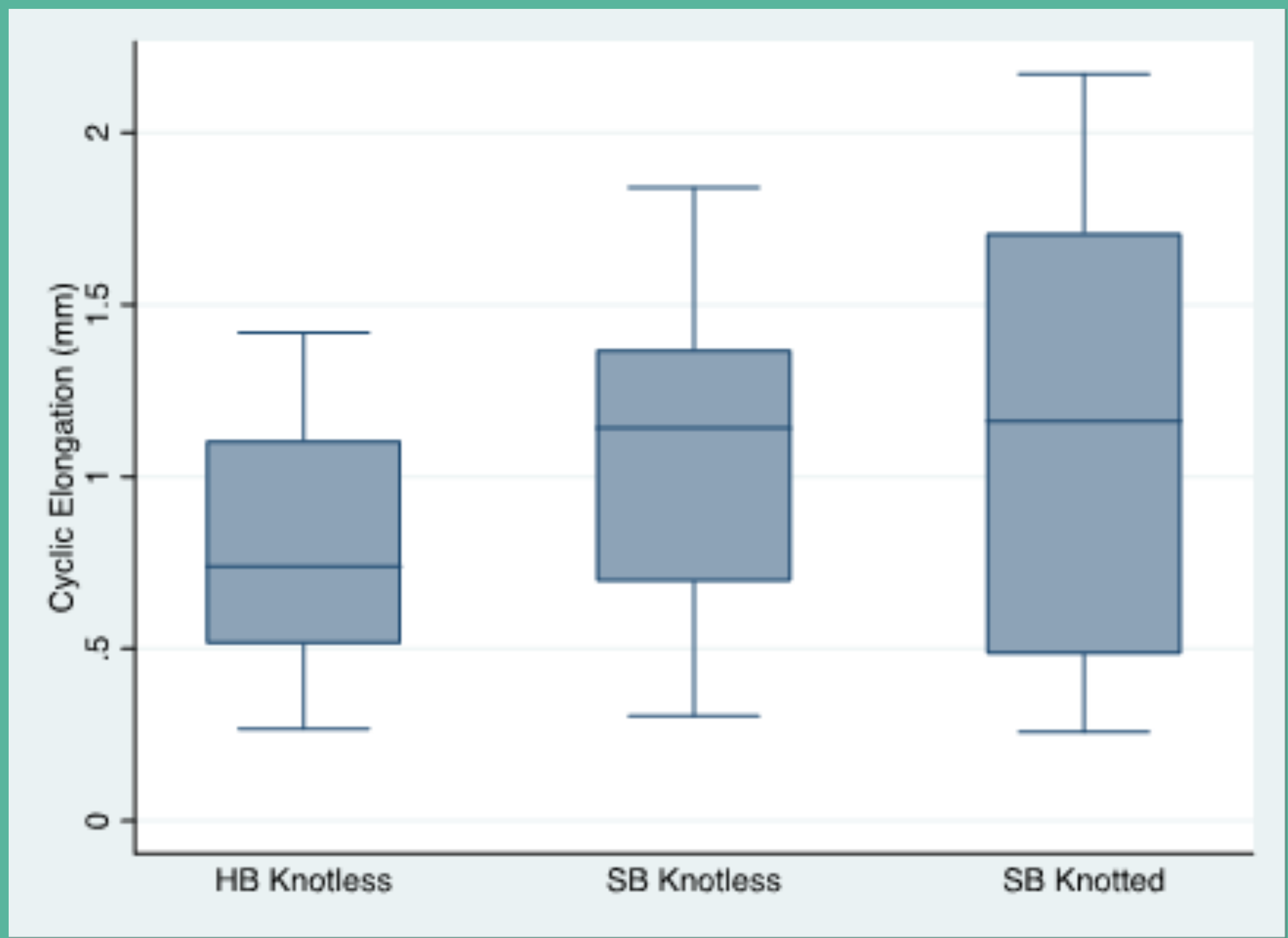

Figure 4. Boxplot demonstrating cyclic elongation by anchor type

RESULTS

Human Cadaveric Properties

Anchor Group	SB Knotless	SB Knotted	HB Knotless	P-Value
Age (years)	58.3 ± 7.3	62.6 ± 7.1	58.6 ± 5.9	0.43
Body Mass Index	26.0 ± 7.6	26.5 ± 5.8	30.4 ± 6.2	0.42
Bone Mineral Density (HU)	254.0 ± 59.9	238.4 ± 59.9	254.6 ± 51.1	0.84
Laterality (Right)	4 (57.1%)	6 (85.7%)	7 (100%)	0.26
Sex (Female)	0 (0%)	4 (57.1%)	2 (28.6%)	0.098

Figure 4. Human cadaveric shoulder specimen properties

- Cadaveric specimen were similar in age, BMI, bone mineral density, laterality, and sex

Impact of Demographic Factors

- As shown in Figure 1, no anchor types were found to be significantly different in max load to failure, stiffness, and cyclic elongation among our other variables

Figure 5. Demonstration of failure mechanisms by anchor type

Failure Mechanisms

- As seen in Figure 5, SB knotless anchors had 0 failure due to anchor fixation, supporting the authors hypothesis
- Data support the benefit of SB knotless anchors in avoiding know failure seen with knotted anchors

CONCLUSION

- The SB knotless device had significantly fewer anchor fixation method failures than the SB knotted anchors
- With no significant mechanical testing differences found between the three anchor, all suture anchors provide adequate repair strength for Bankart lesions
- HB knotless and SB knotless anchors had different failure mechanisms revealing an area of future study
- Advantages of the new SB knotless anchors include:

1. Smaller holes in the glenoid which may reduce fractures
2. Due to size, multiples places of fixation can be achieved
3. Facilitates percutaneous placement of anchors allowing inferior fixation, critical to instability repairs
4. Allow opportunity to retention anchors
5. Removes variability/difficulty with knot tying