INTRODUCTION
Current emphasis in rotator cuff surgery has been on anatomic repair of the footprint to enhance biologic healing and strength. Despite simplification of transosseous-equivalent techniques using knotless fixation with fibertape (Speedbridge) (Arthrex, Naples, FL), external rotation experienced by these constructs during postoperative rehabilitation may lead to construct failure. The hypothesis of this study was that addition of horizontal mattress sutures to the medial row anchors in the Speedbridge construct will enhance the biomechanical properties in both cyclic and failure testing parameters. Therefore the objective of this study was to evaluate the biomechanical integrity of a rotator cuff repair using Speed-Bridge vs Speed-bridge with additional medial row horizontal mattress sutures enhancement and to assess the pattern and sequence of failure of suture/anchor knot complexes.

METHODS
8 fresh-frozen human cadaveric shoulders (5 males, 3 females, age: ±11 years old, range: 33 – 68 years old) were utilized in this study and all soft tissues were carefully dissected from the scapula and proximal humerus. After the supraspinatus tendon was sharply removed from the greater tuberosity, the distal 10mm of the supraspinatus tendon was resected from anterior to posterior to standardize rotator cuff tear simulation. The humerus was cut transversely in the midshaft region approximately 7 cm from the medial surgical neck and potted in 1 ½” polyvinylchloride (PVC) pipes for testing. A basic Speedbridge repair (Fig. 1a) was performed while in 8 contralateral match-paired specimens, a modified Speedbridge with 4 passes for the medial row anchors (Fig. 1b) was performed. Specimens were kept moist during all phases of dissection, preparation, and testing with normal saline solution. A custom jig was employed that allowed dynamic external rotation (0°-30°) with loading (Fig. 2) and a custom made cryoclamp with liquid nitrogen was used to prevent the supraspinatus muscle from soft tissue slippage during loading. The loading parameter for each repaired shoulder was to cyclically load repairs from 0N-180N for 30 cycles and then to failure. Paint markers (Fig. 3) were placed on the supraspinatus tendon for video digitizing system and WINanalyze software (Mikromak Service, Berlin, Germany) was utilized for displacement and gap formation data analysis. Paired Student t tests were used for each variable of interest with the significant level set at p<0.05.

RESULTS
Ultimate load to failure was significantly higher in the Speedbridge with medial row mattress enhancement (Fig. 4, 549N vs. 311N)(p=.01). Linear stiffness in the 1st and 30th cycles and at failure was significantly higher (Fig. 5, p=.02/.02/.04) in the Speedbridge with medial row mattress enhancement as well. Energy absorbed by the repaired tissue was significantly less in the Speedbridge with medial row mattress enhancement at the 1st and 30th cycle and at ultimate load to failure (p=.03/.02/.04). Anterior gap formation occurred significantly greater in the basic Speedbridge at the 1st (4.55 mm vs. 1.35) and 30th cycle (7.67mm vs 1.77mm)(p=.02).

CONCLUSIONS
The Speedbridge with medial row mattress enhancement shows improved biomechanical properties when allowing for external rotation during high-load testing. As has been previously elucidated, external rotation causes potential differential strain on the anterior and posterior aspects of repair constructs. However, this study is the first to evaluate knotless repairs utilizing a dynamic external rotation model. As observed in the present study, utilizing an additional horizontal mattress in the medial row anchors helps to protect the footprint repair from this differential strain, while providing enhanced stability for an optimal healing environment.

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REFERENCES

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