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The primary factor for suture configuration at rotator cuff repair: Width of mattress or distance from tear edge



Onur Hapa^{a,*}, Ahmet Karakaşlı^a, Onur Başçı^a, Hakan Cici^a, Berivan Çeçen^b, Hasan Havitçioğlu^a

^a Department of Orthopedic Surgery, Dokuz Eylül University, İzmir, Turkey

^b Department of Biomechanics, Dokuz Eylül University, İzmir, Turkey

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ABSTRACT

Objectives: The aims of this study was first to investigate whether the bite size or the bite distance from the tear edge is of primary importance in mattress suture configuration for rotator cuff repair. Secondly, whether the use of a 450 left side bent Arthro-Pierce™ (Smith & Nephew, Andover, USA) during suture passage can be more effective on the strength of the configuration compared to a straight Arthro-Pierce™.

Materials and methods: Twenty-eight bovine infraspinatus muscle tendons were randomized into four groups. Group 1; 5 mm wide 'bite size' × 15 mm length 'distance from the tear edge's mattress'; Group 2: 7.5 mm × 10 mm; Group 3: 15 mm × 5 mm 'using straight Arthro-Pierce™' and Group 4: 5 mm × 15 mm using left sided 450 bent Arthro-Pierce™. The repair specimens underwent cyclic loading prior to loading the failure testing. Cyclic elongation (mm), peak-to-peak displacement (mm), ultimate load (N), stiffness (N/mm) and failure mode were recorded for each specimen.

Results: The mean ultimate load in Group 1 was higher compared to group 3. The peak to peak displacement was higher in Group 4 compared to Group 1 ($p < 0.05$). The predominant failure mode in Groups 1, 2 and 4 was suture rupture. The Group 3 most specimens failed due to suture cut through the tendon.

Conclusion: Bite size from the edge of the tendon seems to be more important than the width of the mattress. The curve of the suture passing device may also have an effect on the strength of the suture tendon interface.

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Introduction

Despite the advances in the arthroscopic repair techniques of rotator cuff tendon tears, the re-tear rates still remain high at 14–25%.¹ Suture-tendon interface is still identified as the weakest link of the repair despite the introduction of newly designed anchors and high strength sutures.² Although various suture configurations have been tested in previous biomechanical studies,^{3–5} the most widely used stitch configurations are simple, mattress or a combination of the two, the massive cuff stitch,^{6–8} since the

mattress suture is stronger than a simple suture.^{6,9} Recent studies have reported that the medial or lateral distance of the stitch from the tear edge^{2,10,11} and bite size of the horizontal mattress configuration (distance between the limbs passed through the tendon)¹² has an effect on the strength of the mattress configuration repair. No study has reported the effect of both parameters though.

Recently, it was also proven that arthroscopic devices, used for suture passage, make bigger holes in the cuff, that result in a weaker suture-tendon interface.^{10,13}

The purpose of this study was to investigate whether the bite size or bite distance from the tear edge is of primary importance in rotator cuff repair and whether using a 45° left-bent ARTHRO-PIERCE™ (Smith & Nephew Inc., Andover, MA, USA) or a straight ARTHRO-PIERCE™ instrument during suture passage would have a greater effect on the strength of the configuration. The hypothesis was that increasing the bite size of the mattress configuration

* Corresponding author.

E-mail address: onurhapa@gmail.com (O. Hapa).

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would compensate for the shorter bite distance from the tear edge (that the area of the rectangle covered by the mattress suture 'bite size times the distance from the tear edge' is kept constant) and using the 45° bent ARTHRO-PIERCE™ instrument would cause the strength of the configuration to weaken.

Materials and methods

Twenty-eight bovine shoulder specimens were obtained from an abattoir for this study. All specimens were harvested from male calves (age: 16 months) and frozen immediately at -20°C . Before testing, the specimens were thawed, and the infraspinatus muscle with the tendon attached was dissected from its insertion site at the humerus and removed.

For all specimens, tendon thickness was measured using a digital caliper. The three suture configurations were randomly placed in each set of tendon specimens. Seven tendon specimens were tested for each suture configuration.

All procedures were performed by a single investigator. There were four test groups. Groups 1, 2 and 3 used a straight ARTHRO-PIERCE™ instrument with three different suture configurations (Group 1: 5 mm wide 'bite size' \times 15 mm length 'distance from the tear edge'; Group 2: 7.5 mm \times 10 mm; Group 3: 15 mm \times 5 mm). Group 4 used a left-sided, 45° bent ARTHRO-PIERCE™ instrument with 5 mm \times 15 mm suture configuration (Fig. 1). Each stitch was created using a no.2 FiberWire® (Arthrex, Inc., Naples, FL, USA) suture.

Biomechanical testing

The tendon repair construct was mounted securely in the jaws of a materials testing system (AG-I 10 kN; Shimadzu Corp., Kyoto,

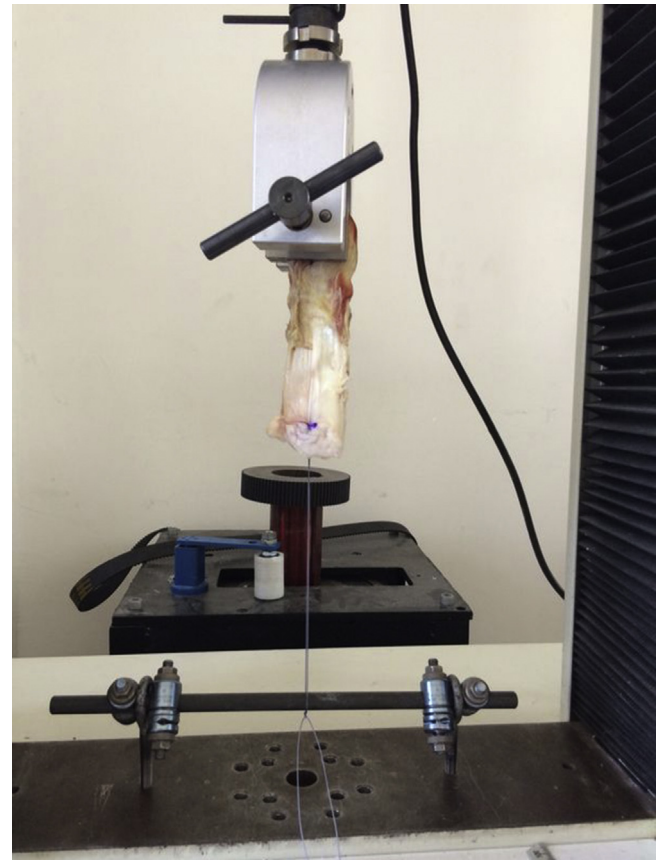


Fig. 2. Test set-up.

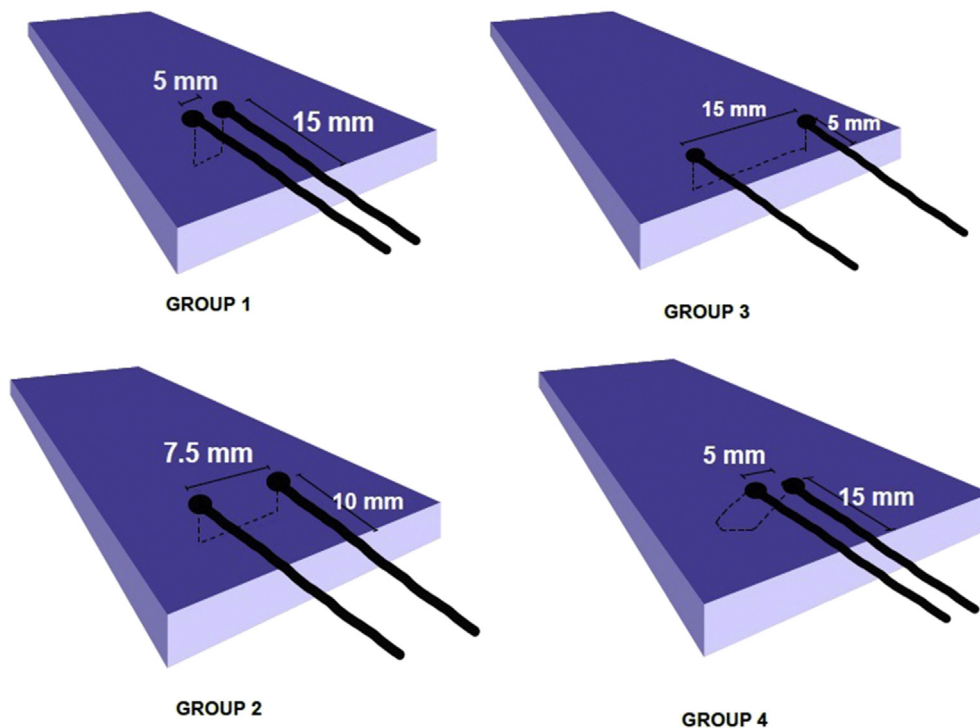


Fig. 1. Groups tested.

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