



Original Article

Knee ligament injuries: biomechanics comparative study of two suture technique in tendon – analysis “in vitro” tendon of bovine

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Objective: To evaluate and compare the biomechanical behavior of two different suture configurations: “X” and “Loop” in the preparation of tendons for knee ligament reconstruction. **Methods:** We used common digital extensor tendons of bovine that can replace the human flexor tendons in experimental studies of traction. In the first group, point “X” suture with Ethibond® No. 5 began in the distal graft points transfixing, with spacing of 7.5 mm points to reach 03 cm distal to the beginning of the suture, returning suture in the same manner, transfixing the tendon in open spaces across the suture configuration “X”. The second group, the point “Loop” was prepared with the same type Ethibond® No. 5 of the needle wire was removed for use only of the wire was mounted in a twofold manner in a single piece forming a needle loop. Started the suture 3 cm from the end of the graft through loops and transfixing points throughout the tendon substance, with spacing between dots of 7.5 mm.

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Result: The Maximum Force of Rupture suture in "Loop" was 444.45 N and the suture in "X" was 407.59 N with statistical significance ($p = 0.030$). The average Tension obtained at the suture in "Loop" was 27.67 MPa and at the suture in "X" was 25.73 MPa with a statistically significant difference ($p = 0.036$). The stiffness showed no statistical differences ($p = 0.350$) at 11.804 N / mm at the point where "Loop" and 11.570 N / mm at the suture "X". Conclusion: The suture in "Loop" had a higher biomechanical behavior to the suture "X", considering the Maximum Force and Tension.

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Introduction

Ligament injuries occur very commonly in humans, particularly at knee level, where the anterior cruciate ligament (ACL) is one of the most frequently injured ligaments.¹

Cruciate ligament reconstruction surgery is based on two well-established concepts: a) use of biological grafts with biomechanical characteristics similar to those of the ACL; b) graft fixation as rigidly as possible and as close as possible to the ligament exit point in the joint. The grafts most used for reconstructing knee ligaments come from the central third of the patellar tendon, with its bone insertions, and the tendons of the hamstring muscles or the flexor tendons in a quadruple configuration.² Independent of the type of tendon graft obtained, one of the problems for surgeons consists of adequate preparation of the tendon. Suitably resistant suturing at the time of fixation enables tension levels that are sufficient for promoting the best conditions for graft incorporation to the host bone.

However, there is no standard preparation method, or any consensus regarding the best technique. There are probably as many techniques for graft preparation as there are surgeons performing ACL reconstruction surgery.³ Stitches such as the whipstitch, whipknot, Prusik knot, Kessler, crisscross, Bunnell, baseball stitch, prefabricated "loop" stitch (Fiber loop) with and without locking and Krackow have been used and described as techniques.^{3,4}

The aim of the present study was to evaluate and compare the biomechanical behavior of two different suture configurations that were subjected to tests on a traction machine: 1) "X" stitches; 2) "loop" stitches. These were prepared on bovine common digital extensor tendons, which can replace the human flexor tendons in experimental traction-test studies.⁵

Material and method

Ten common digital extensor tendons from cattle of Nellore breed were acquired fresh from a specialist beef slaughter and trading company. The distal part of the anterior limb of

the cattle was obtained for extraction. The animals' mean age was two years.

Each tendon was divided, thus forming a total of 20 paired tendons that simulated the flexor, gracilis and semitendinosus tendons of the human knee.⁵ The pairs were divided into two groups of ten tendons and were all cut to the length of 20 cm.

The first group, defined as the "X" configuration, was prepared using synthetic polyester Ethibond® No. 5 braided thread on a needle. The suturing was started in the distal portion of the graft, on one of the margins, using transfixing stitches across the entire substance of the tendon, with spacing of 7.5 mm between the stitches, until reaching 3 cm distally to the start of the suture. The suturing then returned along the line in the same manner, from the same margin as at the start of the suture, transfixing the tendon in the open spaces, intercalating the stitches and crossing the suture line in an "X" configuration. The same procedure was followed at the other end of the tendon (Figs. 1 and 2).

The second group, defined as stitches in a "loop" configuration, was prepared with the same type of synthetic

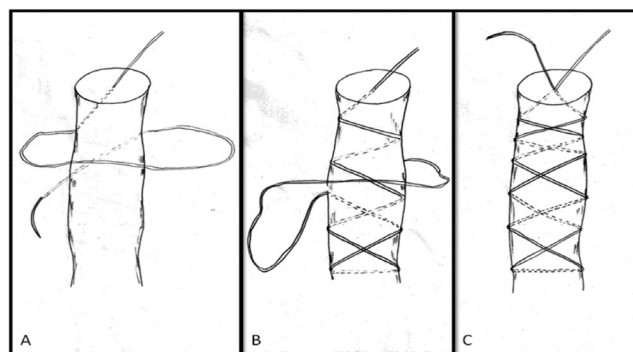


Fig. 1 - (A) Start of preparation of stitches in "X" configuration in the distal portion of the tendon, with transfixing stitches along the entire substance, with spacing between stitches of 7.5 mm. (B) Returning along the suture line in the same manner, transfixing the tendon in the open spaces. (C) Stitch in "X" configuration completed.

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