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Biomechanical Evaluation of Suture Anchor Versus Transosseous Tunnel Quadriceps Tendon Repair Techniques

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Summary:
In this cadaveric biomechanical study, suture anchor repair of quadriceps tendon tears demonstrated superior resistance to cyclic loading and equivalent ultimate load to failure when compared to traditional transosseous tunnel techniques.

Abstract:
INTRODUCTION
The current gold standard for management of an acute quadriceps tendon rupture is surgical repair through transosseous patellar bone tunnels. Few studies have been published comparing the biomechanical properties of suture anchors versus transosseous patella tendon repair. The purpose of our study is to evaluate the biomechanical fixation strength of suture anchor versus transosseous tunnel repair of the quadriceps tendon. Our hypothesis is that suture anchor repair will have significantly greater stiffness following cyclic loading and maximum load to failure when compared to traditional fixation techniques.

MATERIALS & METHODS
Power analysis was performed and a total of 12 cadaveric 'patella only' specimens were used. DEXA measurement was performed to ensure equal bone quality amongst groups. Specimens were then randomly assigned to the following groups:
1. Suture anchor repair of quad tendon (n=6 each)
2. Transosseous tunnel repair of quadriceps tendon (n=6).

Besides these variables, suture type and repair configuration were equivalent. After the respective procedures were performed, each patella was mounted into a gripping jig. Tensile load was applied at a rate of 0.1mm/s up to 100N after which cyclic loading was applied at a rate of 1Hz between magnitudes of 50N and 150N, 50N and 200N, 50N and 250N, and tensile load at a rate of 0.1mm/s until failure. Failure was defined as a sharp deviation in the linear load vs. displacement curve. Outcome measures included displacement at 1st 100N load, as well as displacement after each 10th cycle of loading, and load to failure. Failure mode was recorded.

RESULTS
The measured cyclic displacement to the 1st 100N, 50-150N, 50-200N, and 50-250N was significantly less for suture anchors than it was for transosseous tunnels. There was no statistically significant difference in ultimate load to failure between the transosseous and suture anchor groups (p=0.40). Failure mode for all suture anchors except one was through the soft tissue. One specimen failed through the suture anchor. Failure mode for all bone tunnel specimen but one was pulling the repair know through the transosseous tunnel.

DISCUSSION
In this cadaveric biomechanical study, suture anchor repair of quadriceps tendon rupture had superior resistance to

cyclic loading and equivalent ultimate load to failure when compared to the transosseous tunnel technique. Suture anchors failed through the soft tissue, while the transosseous tunnel failed through the bone. While in vivo studies are needed, these results support suture anchor technique as a viable alternative to transosseous repair of the quadriceps tendon.