BIOMECHANICAL EVALUATION OF A NOVEL SUTURE ANCHOR FOR ROTATOR CUFF REPAIR

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INTRODUCTION

Rotator cuff repair in the osteoporotic patient presents challenges [1]. Suture fixation using anchors or transosseous tunnels can fail due to poor bone quality. This study assessed the biomechanical performance of a novel suture anchor designed to achieve knotless transosseous fixation of rotator cuff repairs. The experimental anchor comprised a tapered plug and tapered shouldered hub made from medical-grade polyether ether ketone (PEEK), combined with Size 2 suture. Tests were performed on Prototype 1 (two plug types), leading to design changes instituted in Prototype 2 (Figure 1).

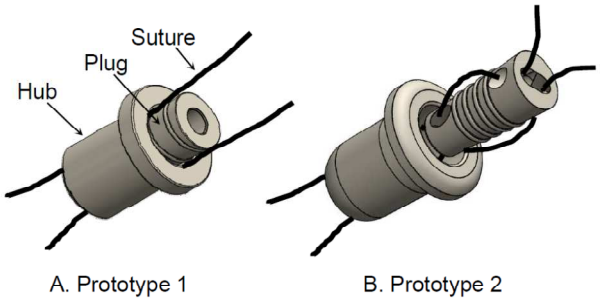

Figure 1: Diagrams of anchor hub and plug, with suture path.

METHODS

Custom fixtures and a materials testing machine (8874, Instron, Norwood, MA) were used to assess the biomechanical performance of anchor designs, suture types and dry/wet conditions. Anchor-suture constructs were tested to failure in two modes. *Suture pull-through*: the anchor-suture construct was assembled with a standardized plug locking force, beads were glued to the suture to track motion, the construct mounted in a custom fixture (Figure 2a) and a tensile load applied (1mm/s) to the suture loop. *Plug push-through*: the anchor-suture construct was mounted in the fixture (Figure 2b), and a compression load applied (1mm/s) to the plug with a custom pin. Peak load, mode of failure and suture stretch and slip was assessed.

RESULTS AND DISCUSSION

Suture pull-through: The mean ultimate load for Prototype 1 (across both plug types and three suture types, n=12) was 158.1 N (SD 48.0) and the predominant mode of failure was suture pulling through the hub-plug interface. Suture-guide fenestrations were added to the Prototype 2 plug to eliminate suture drift around the plug circumference and reduce ultimate load variability. Prototype 2 results are shown in Table 1.

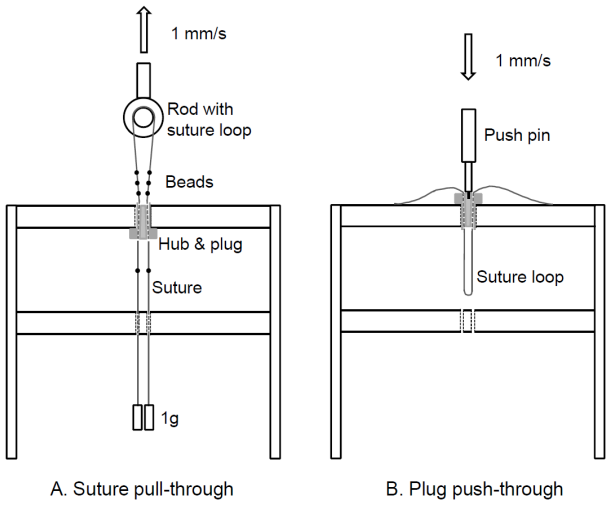

Figure 2: Anchor test configuration schematics (not to scale).

Table 1: Suture pull-through results, Prototype 2. Sutures: Maxbraid, Ethibond; Sawbones model ≈ osteoporotic bone.

Construct	n	Peak load (N) (mean±SD)
MaxBraid Dry	5	168.4±6.5
MaxBraid Wet	5	168.2±7.4
Ethibond Dry	5	137.9±2.5
MaxBraid Dry Sawbones	4	164.0±7.0

Plug push-through: The mean peak load (n=8) for Prototype 1 was 380.6 N (SD 53.1). The plug exited the hub without either component splitting. Tests are pending for Prototype 2.

CONCLUSIONS

Early results indicate the tapered hub and plug provide reproducible suture hold in wet/dry conditions, with different suture types and simulated osteoporotic bone, and peak loads similar to rotator cuff repair anchors in osteopenic bone [2].

ACKNOWLEDGEMENTS

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2. Pietschmann M et al., *Arch Ortho Tr Sur.* **129**:373-9, 2009.

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