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Which is Better for Anterior Cruciate Ligament Supplementary Fixation: Suture Anchor or Staple? A Biomechanical Study

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Disclosures: Nil

Introduction

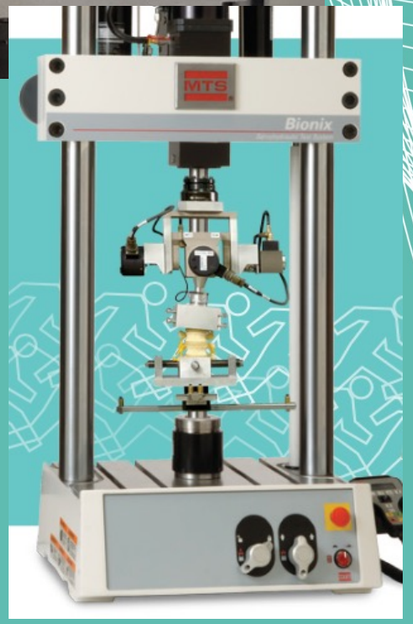
- Staples are used in supplementary tibia fixation for anterior cruciate ligament (ACL) reconstruction
- However, suture anchors are increasingly being used with the following advantages:
  - Low profile
  - Less risk of soft tissue irritation
  - Less implant prominence
- Our study aims to assess the **fixation strength** and **cyclic stiffness** of the two modalities.

Methods

- Porcine tendon grafts implanted in square box Sawbones (*Malmoe, Sweden*) bone block
- 2 fixation systems by *Arthrex (Naples, FL)*:
  - Spiked Ligament **Staples** (11 x 20mm)
  - PEEK Swivelock **Anchor** (4.75 x 19.1mm)
- 8 assemblies performed: 4 per modality

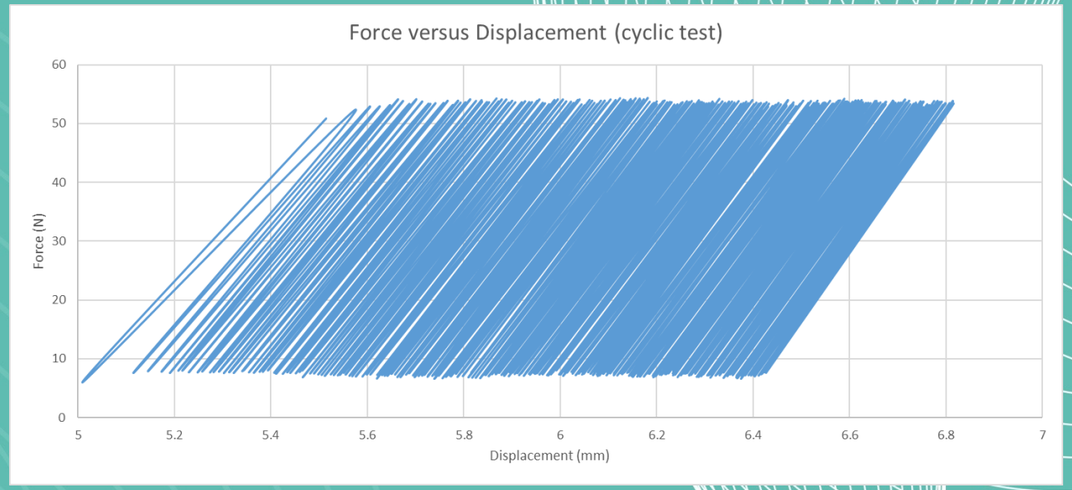
Methods

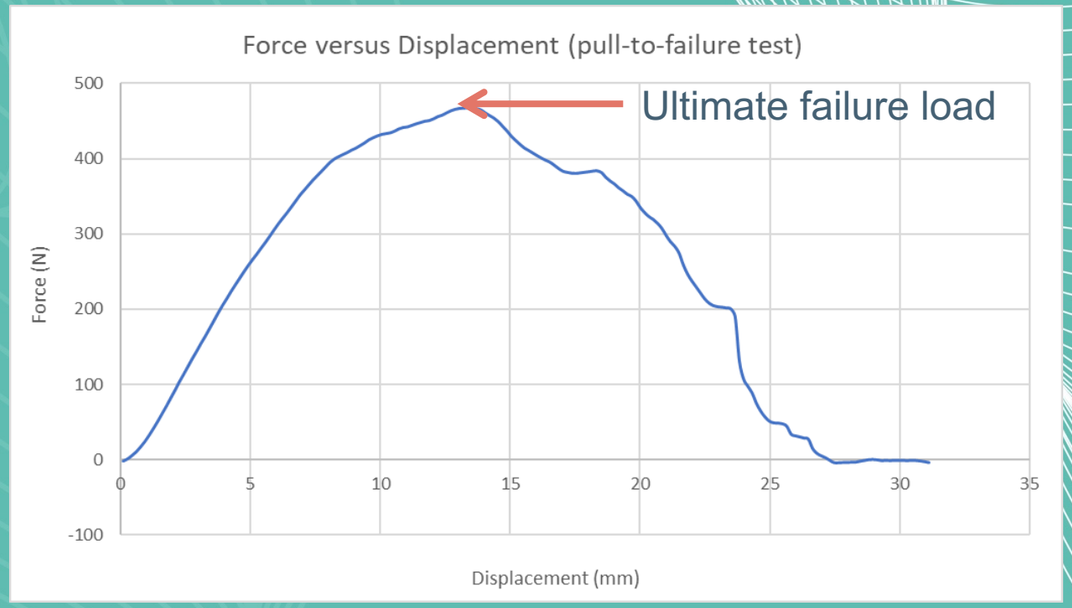
- Proximal end of the graft was sutured to itself to form a loop using high-resistance sutures FiberWire #2 (*Arthrex*)
- This was passed around the hook of the traction machine (*MTS Bionix Model 370.02*)
- The distal end was secured to the bone block which was held at the machine base with a clamp



Methods

- Graft axial traction protocol:
  - Pre-conditioning (10 cycles)
  - 10N to 50N over 250 cycles (1Hz)
  - Pull to failure (rate of 20mm/minute)
- Study parameters:
  - Pull-out strength (ultimate failure load; N)
  - Mean cyclic stiffness (N/mm)
  - Pull-out stiffness (N/mm)

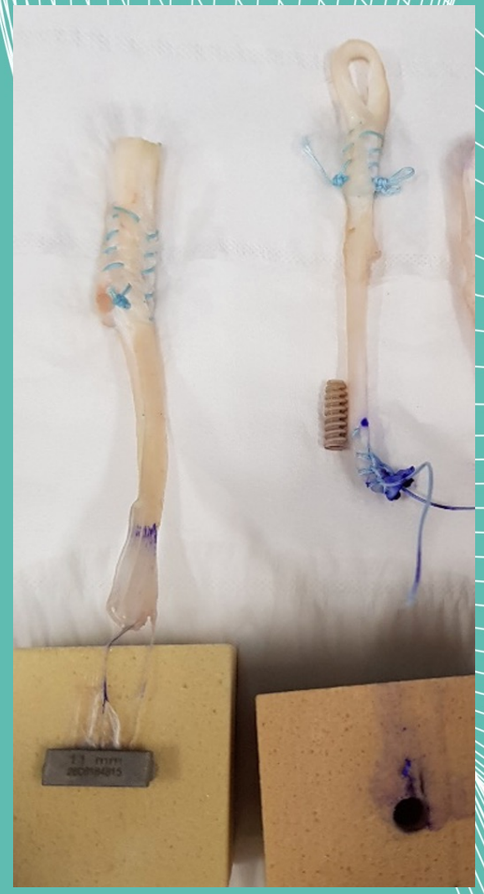




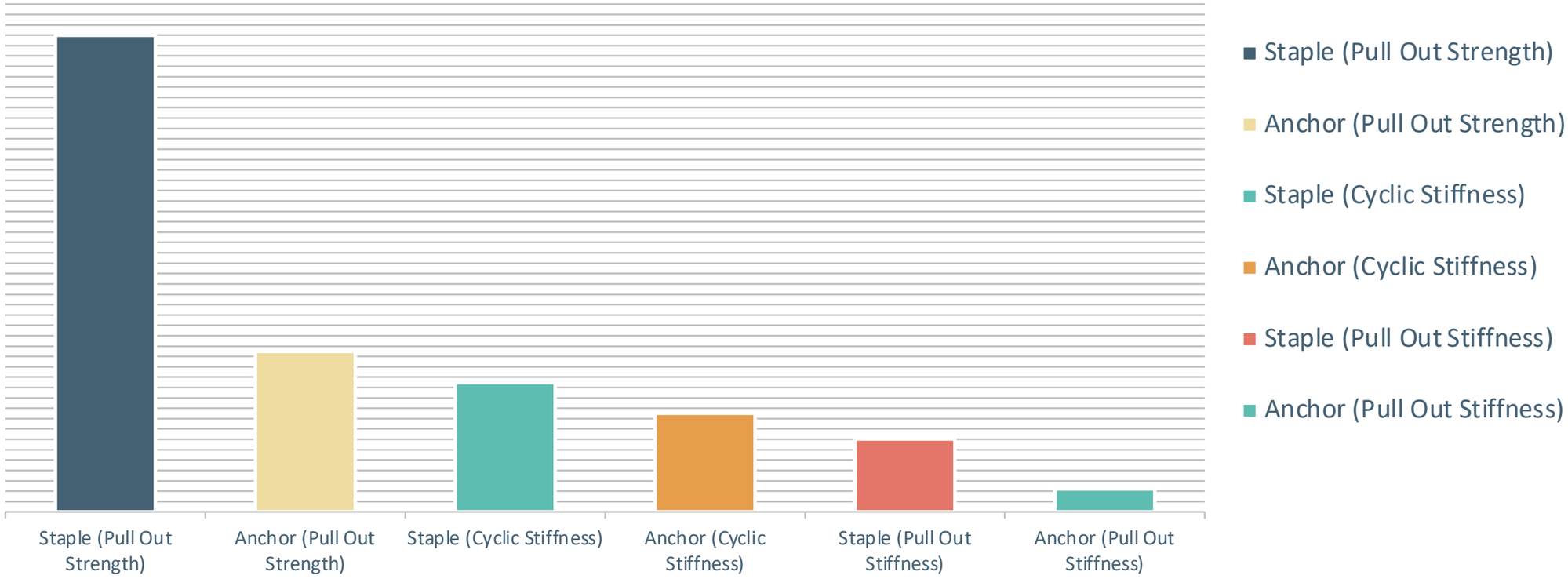
Graphs for Staple (#2)

Results

- Mean pull-out strength:
  - Staple was 459.92 +/- 7.87N (range: 451.24 to 458.01N)
  - Suture anchor, 154.93 +/- 26.19N (range: 130.34 to 179.25N)
  - Staple had a significantly higher pull-out strength (p = 0.02)
- Mean cyclic stiffness:
  - Staple was 124.71 +/- 25.44N/mm (range 103.61 to 160.18N/mm)
  - Suture anchor, 95.15 +/- 12.69N/mm (range 76.76 to 104.69N/mm)
  - Staple had a significantly higher mean cyclic stiffness (p = 0.04)
- Mean pull-out stiffness:
  - Staple was 70.34 +/- 11.3N/mm (range 59.95 to 81.48N/mm)
  - Suture anchor, 22.12 +/- 2.42N/mm (range 19.12 to 24.62N/mm)
  - Staple had a significantly higher mean pull-out stiffness (p = 0.02)



Results



	Staple (n=4)	Anchor (n=4)	p-value
Pull Out Strength (N)	459.92	154.93	0.02
Cyclic Stiffness (N/mm)	124.71	95.15	0.04
Pull Out Stiffness (N/mm)	70.34	22.12	0.02

Conclusion

- Staple showed significantly better pull-out strength, mean cyclic stiffness and pull-out stiffness than the suture anchor.

- Suture anchor is a supplementary fixation, but low-profile advantage comes at the price of a reduced fixation strength and stiffness.

References

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