Biomechanical Evaluation of Fixation Strengths of the Screw Button Constructs in the Latarjet Procedure: A Cadaveric PSI Guided Study

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QUT Queensland University of Technology

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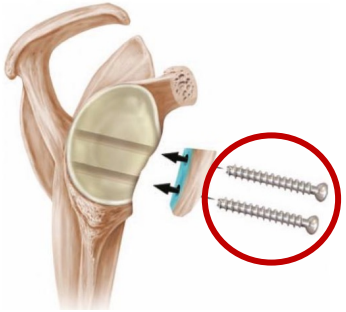
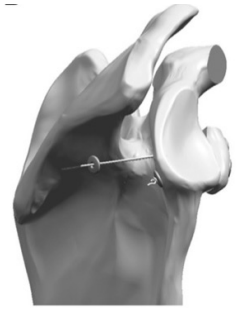
Introduction – Latarjet Procedure Fixation Techniques

- Management of shoulder instability
- Good clinical results but complication rates – **15 - 30%**[1]



From Burkhart et al[2]



From Reeves et al[7]

	+	−
Double screw fixation	• Traditional fixation technique • Good clinical outcomes[3]	• Graft osteolysis[1] & stress shielding • Metallic hardware-related complications[4]
Suture button fixation	• Minimise complications related to metallic hardware • Allow micromotion – promote bone healing[5]	• Previous studies showed inferior biomechanical strengths of the overall construct[6]

[1]Gupta et al, 2015
[3]Mizuno et al, 2014
[4]Butt et al, 2012
[5]Boileau et, 2016
[6]Williams et al, 2020
[7]Reeves et al, 2020

No clinical or biomechanical research comparing potential of Screw Button fixation construct

Objectives

1. Determine load to failures of the double screw (SS), double button (BB) & screw-button (SB) Latarjet fixation constructs
2. Characterise graft displacements for each construct after cyclical loading

Hypothesis

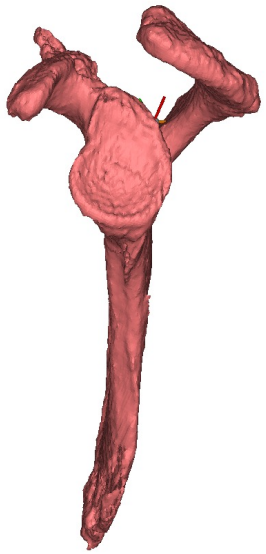
1. There is a significant difference between load to failure for the various fixation constructs

Methods – Patient-specific Latarjet procedure

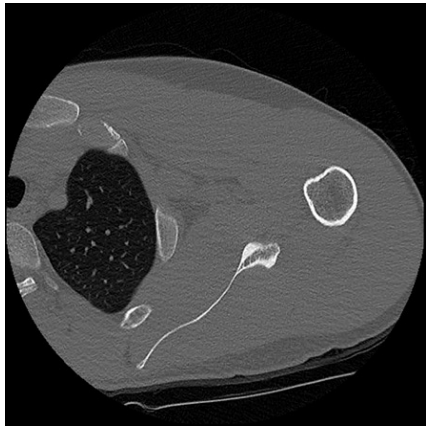
Normal Glenohumeral Joints (B/L)

Determine suitability

Morphological abnormalities
Obvious pathologies
Prior operative intervention

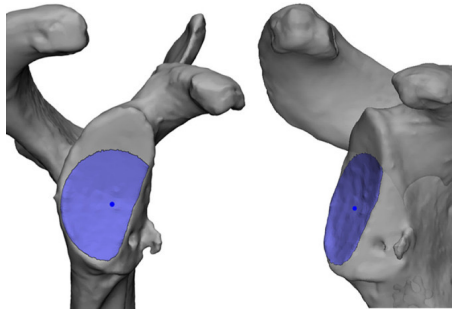


CT Scan



3D Models

Calculate Glenoid Surface Area



Customised 3D-printed Jigs

Standardized 20% defect created

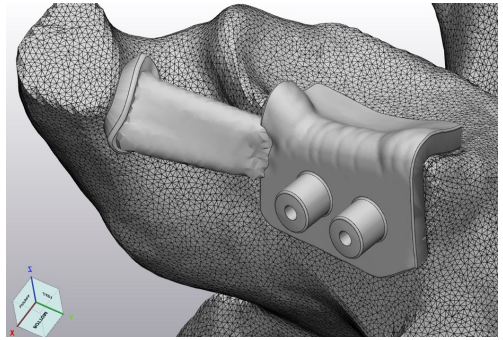
Graft osteotomy

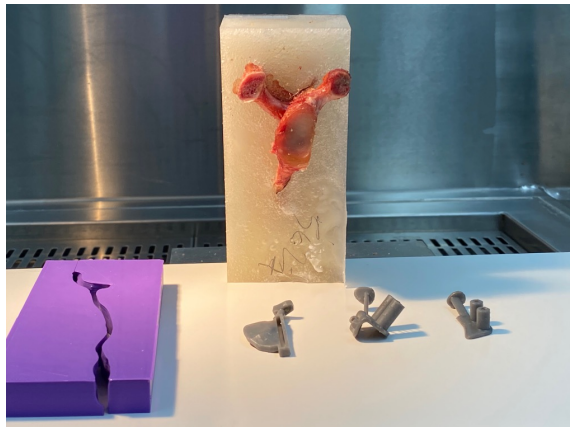
Scapula cut

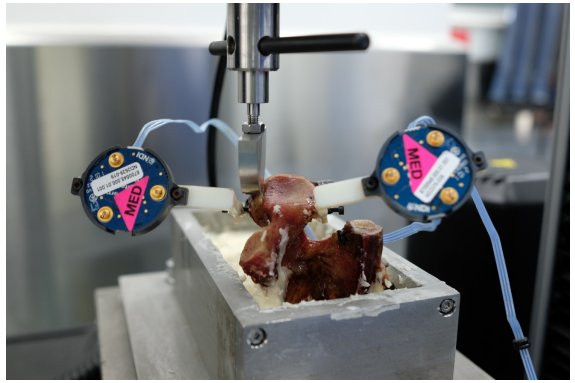
Biomechanical Testing

Cyclic Loading

Load to Failure

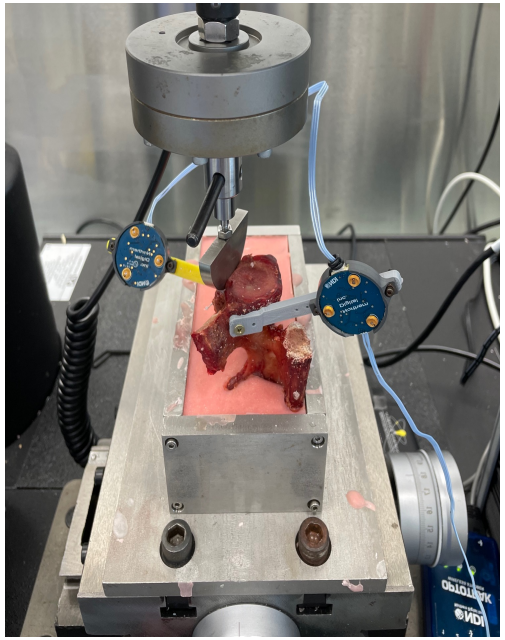


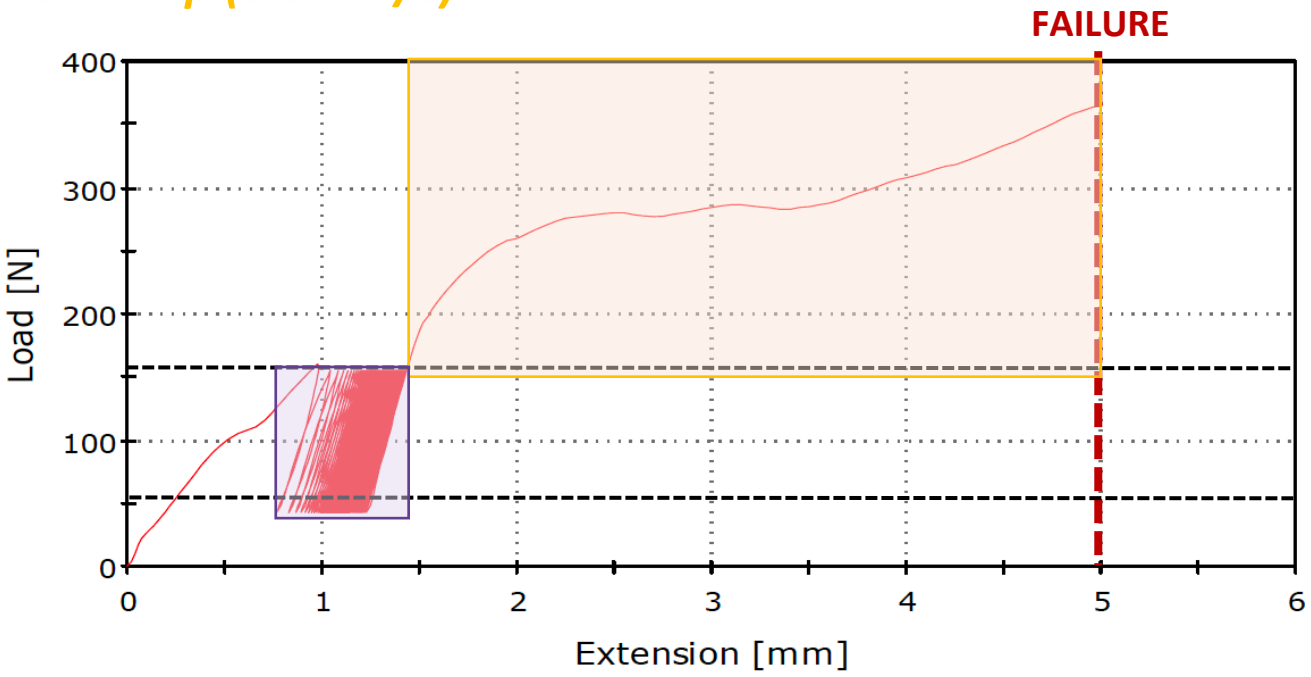


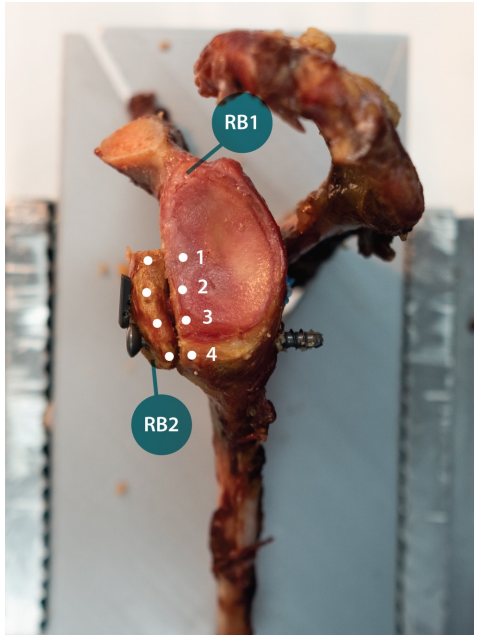


Methods – Biomechanical Testing Protocol

- **Williams et al. (2020)[6]**
  1. ***Preloading 1N***
  2. ***Cyclic Loading: 100 cycles, 50-150N, 1Hz***
  3. ***Load to Failure: Ramp (0.5mm/s)***



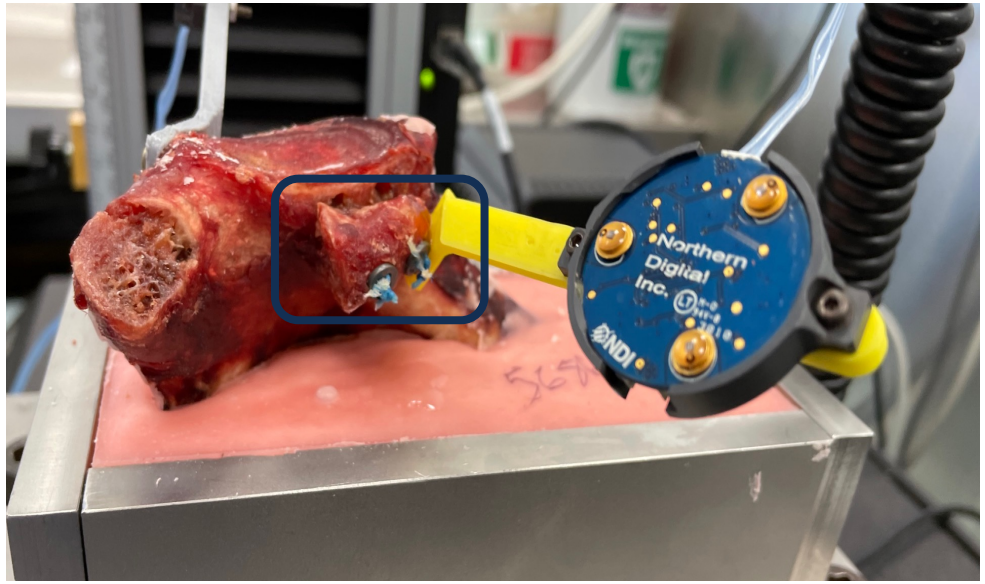




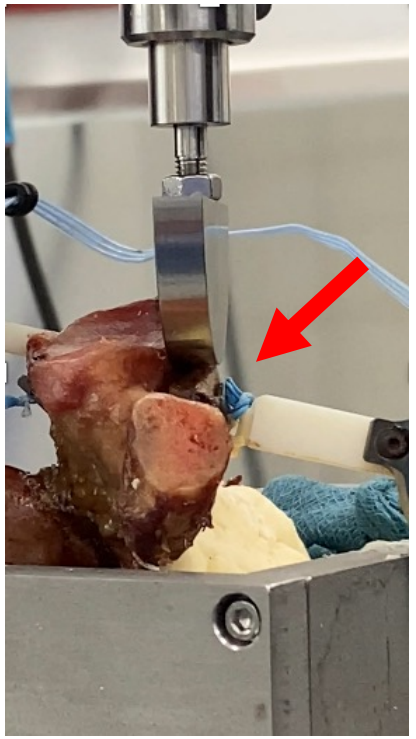
Methods – Biomechanical Testing Protocol

Construct Failure Definition

- *Graft fracture*
- *Screw avulsion/device failure*
- *Graft displacement of >5mm*



Same timepoint



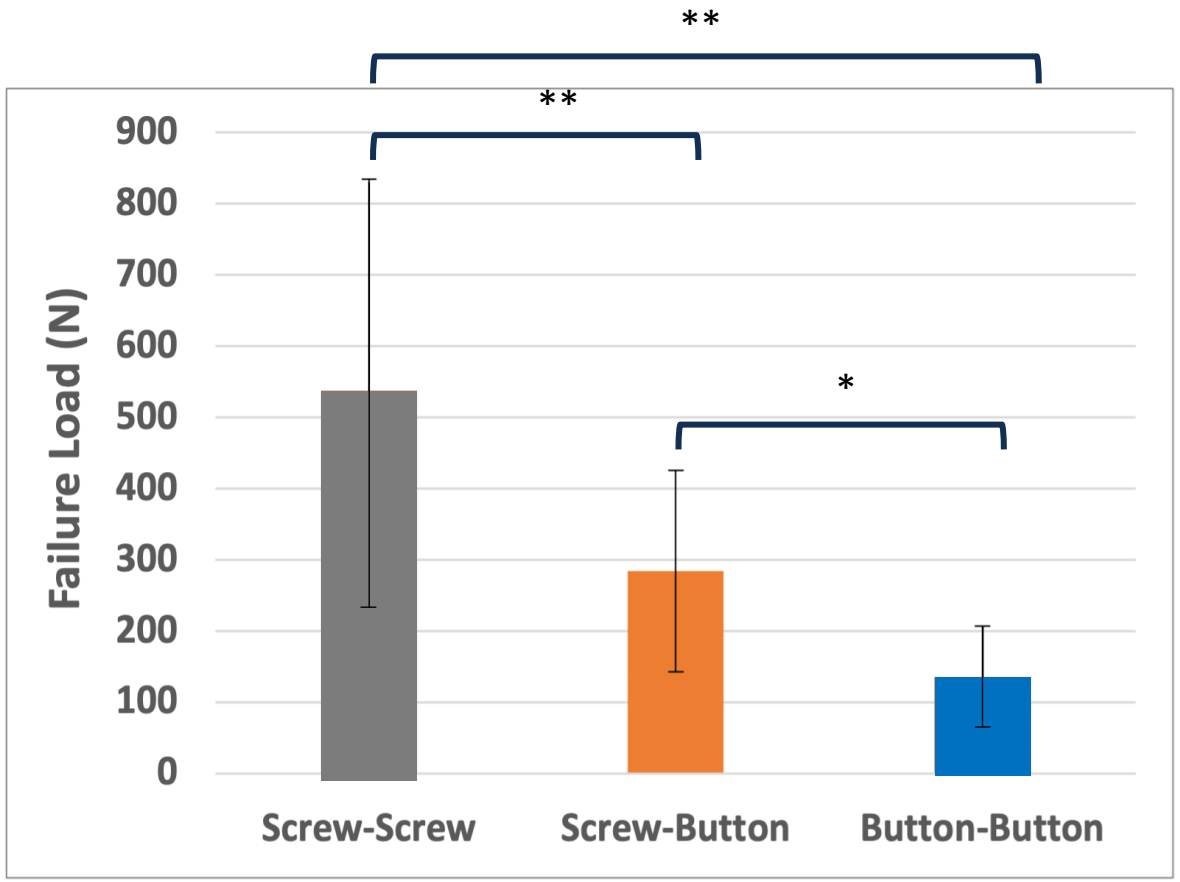
Double Button **BB**

Screw-Button **SB**

Results – Comparison Load to Failure for each construct

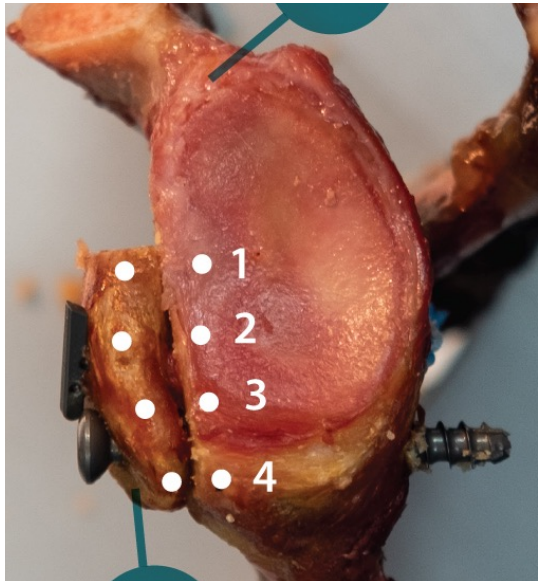
- N = 40 scapulae (20 Matched Pairs)
- Age = 69.30 years (+/- 8.89)
- BMI = 24.10kg/m^2 (+/- 4.29)

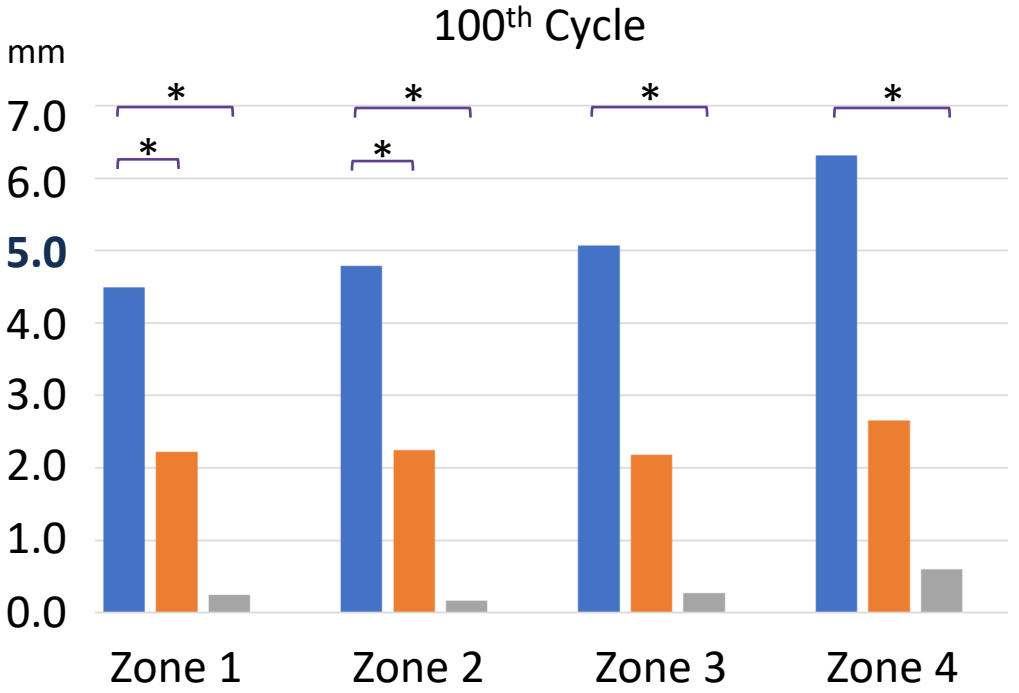
Construct	Load	Type of failure	Time
Screw-Screw SS	537.8N	>5mm displacement	111s
Screw-Button SB	284.0N	>5mm displacement	83s
Button-Button BB	135.1N	>5mm displacement	23s



*p<0.05
**p<0.01

Results – Graft displacement SS + SB + BB





Screw-Screw

Screw-Button

Button-Button

*p<0.05

Conclusion

SB is a viable option for Latarjet fixation

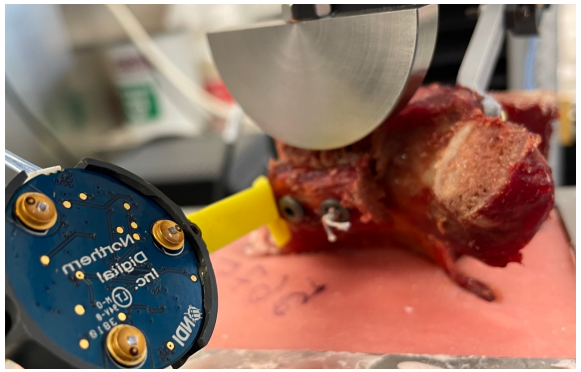
- ↑ Strength
- Uniform displacement

Strengths

- Large PSI cadaveric instability study
- Matched pair analysis
- Standardised surgical procedures

Limitation

- Results are at Time 0
- No load applied to conjoint tendon



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Thank you!