Biomechanical Evaluation of 4 Different Foundation Constructs Commonly Used in Growing Spine Surgery: Are Rib Anchors Comparable to Spine Anchors?

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Disclosures

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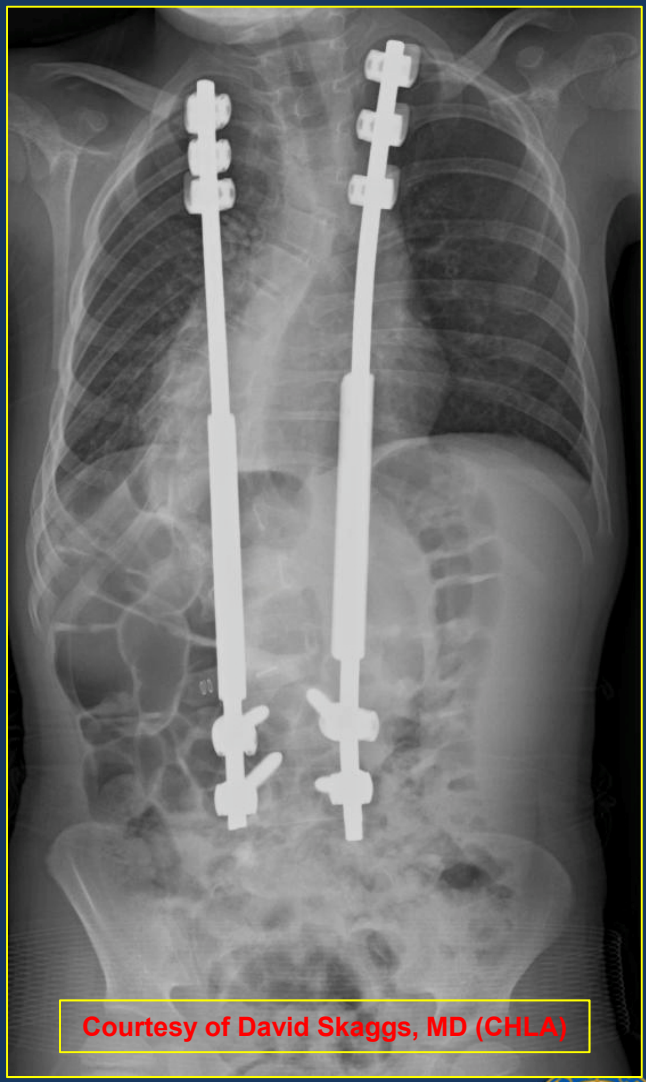
Introduction

- The goals of growth compatible surgery in progressive EOS:
- 1. Control the deformity, 2. Allowing for continued spinal growth

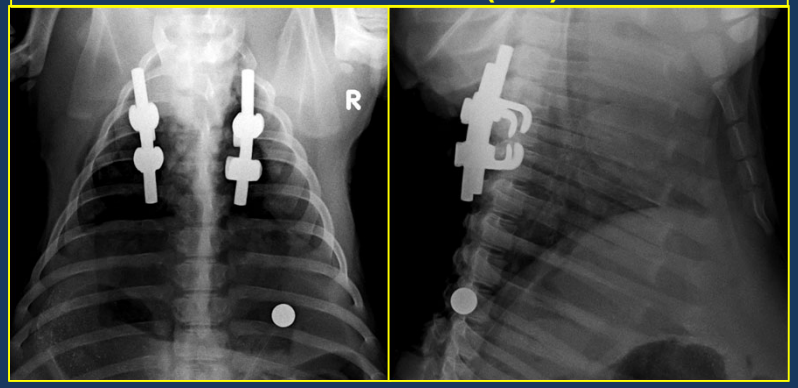
- The foundation sites accept the major distraction forces and are subject to failure



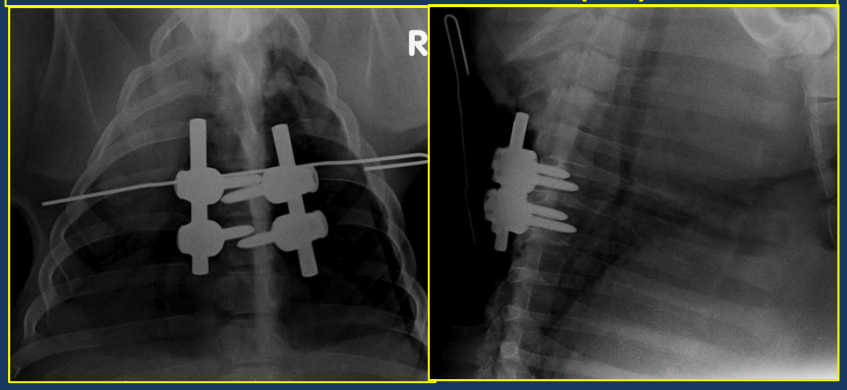
Objectives

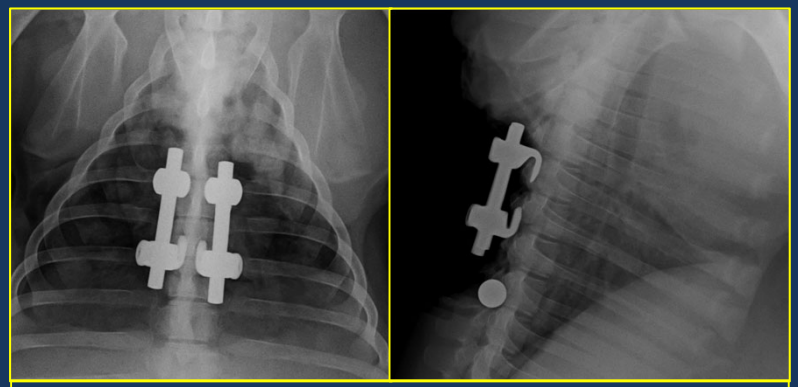
- This study compares the strength of four different constructs under the same loading conditions in an in-vitro porcine model

Rib-Rib Hook (RR)

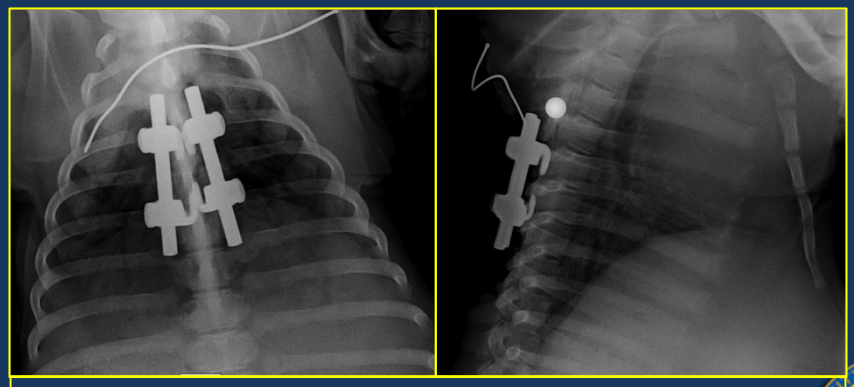


Pedicle Screw-Screw (SS)





Transverse Process-Laminar Hook (TPL)



Laminar Hook-Hook (HH)

Methods & Materials

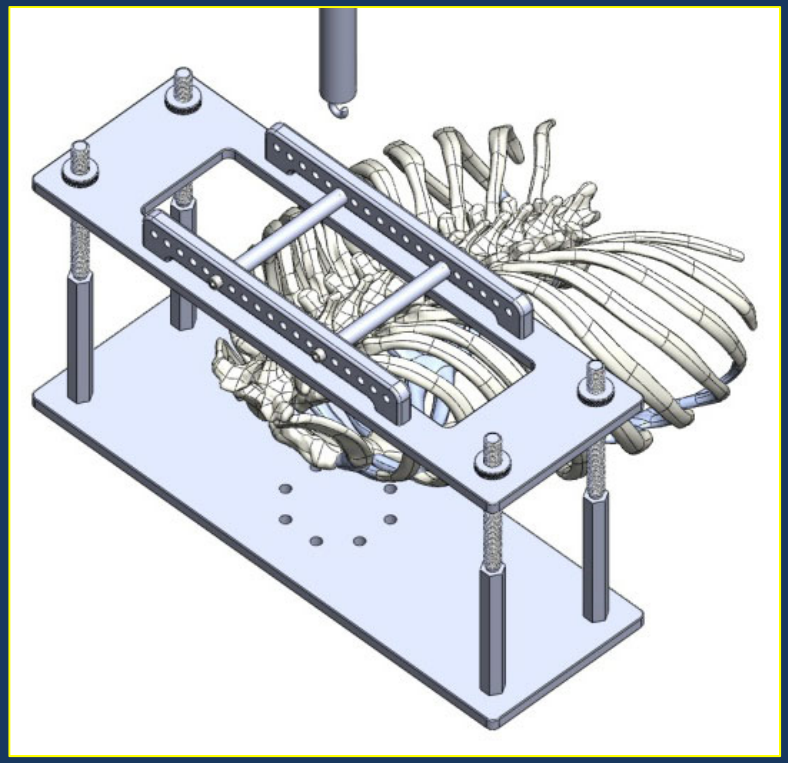
- Forty immature porcine specimens were instrumented randomly with one of four bilateral proximal anchors at T5-T6:

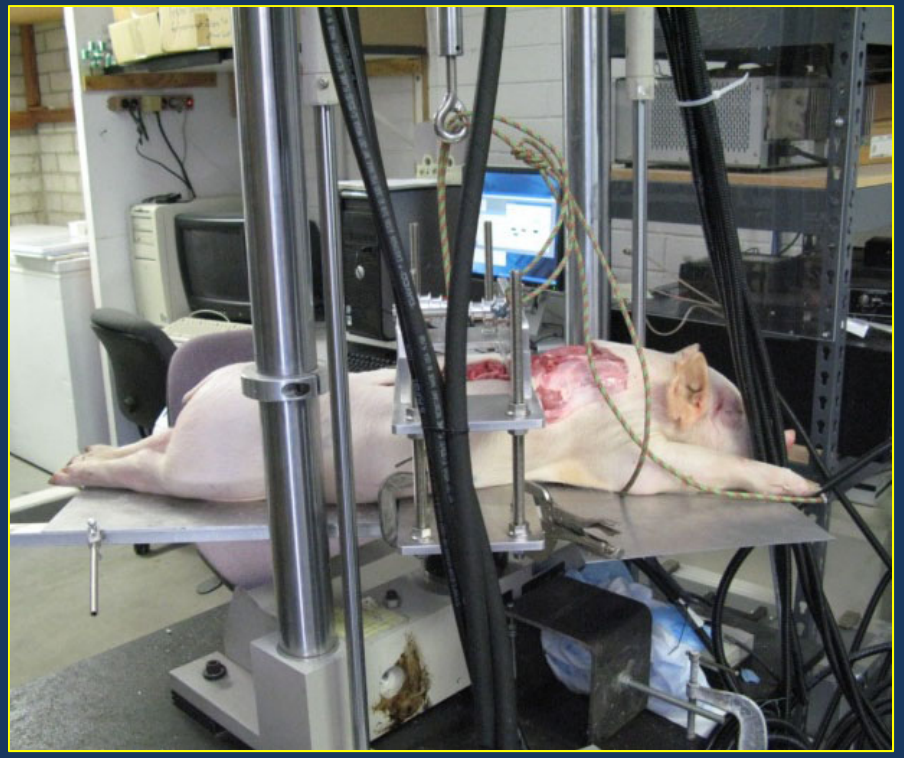
- 10 specimens with Pedicle Screw-Screw (SS)
- 10 specimens with Laminar Hook-Hook (HH)
- 10 specimens with Rib Hook-Hook (RR)
- 10 specimens with Transverse Process to Lamina Hook-Hook (TPL)

- The entire specimen including soft tissues and bony structures were kept intact except the soft tissues at the anchor sites.

Methods & Materials

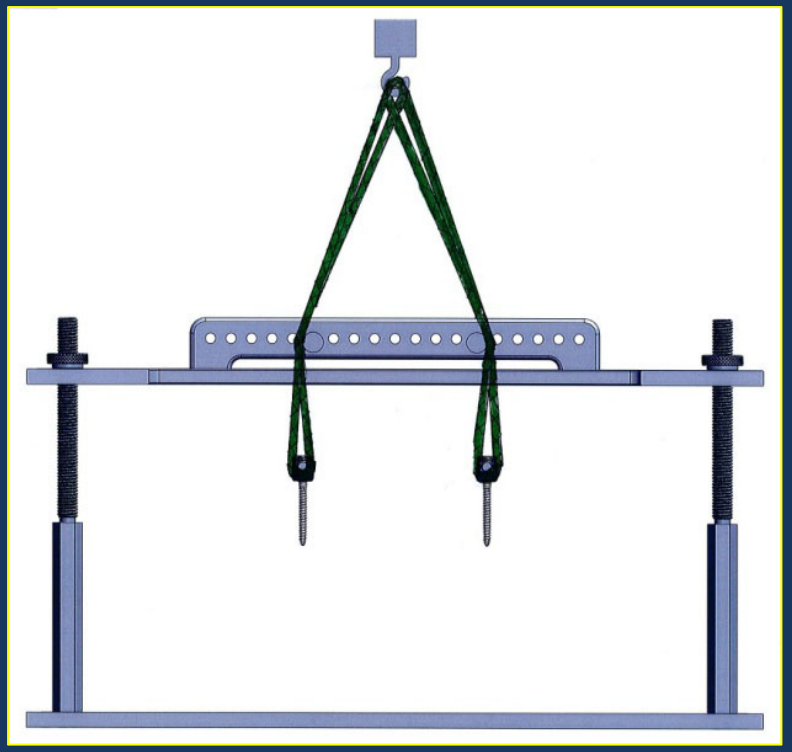
- A unique fixture was designed to brace the specimen and provide a counter-force.

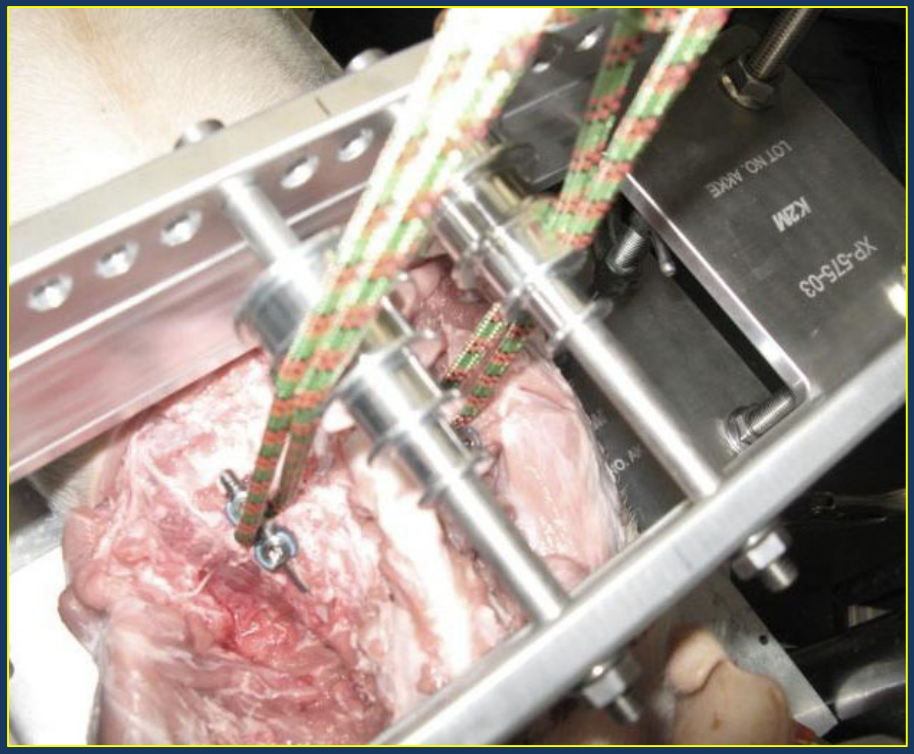




Methods & Materials

- The ultimate load was identified as the greatest load recorded for a construct failure





Results

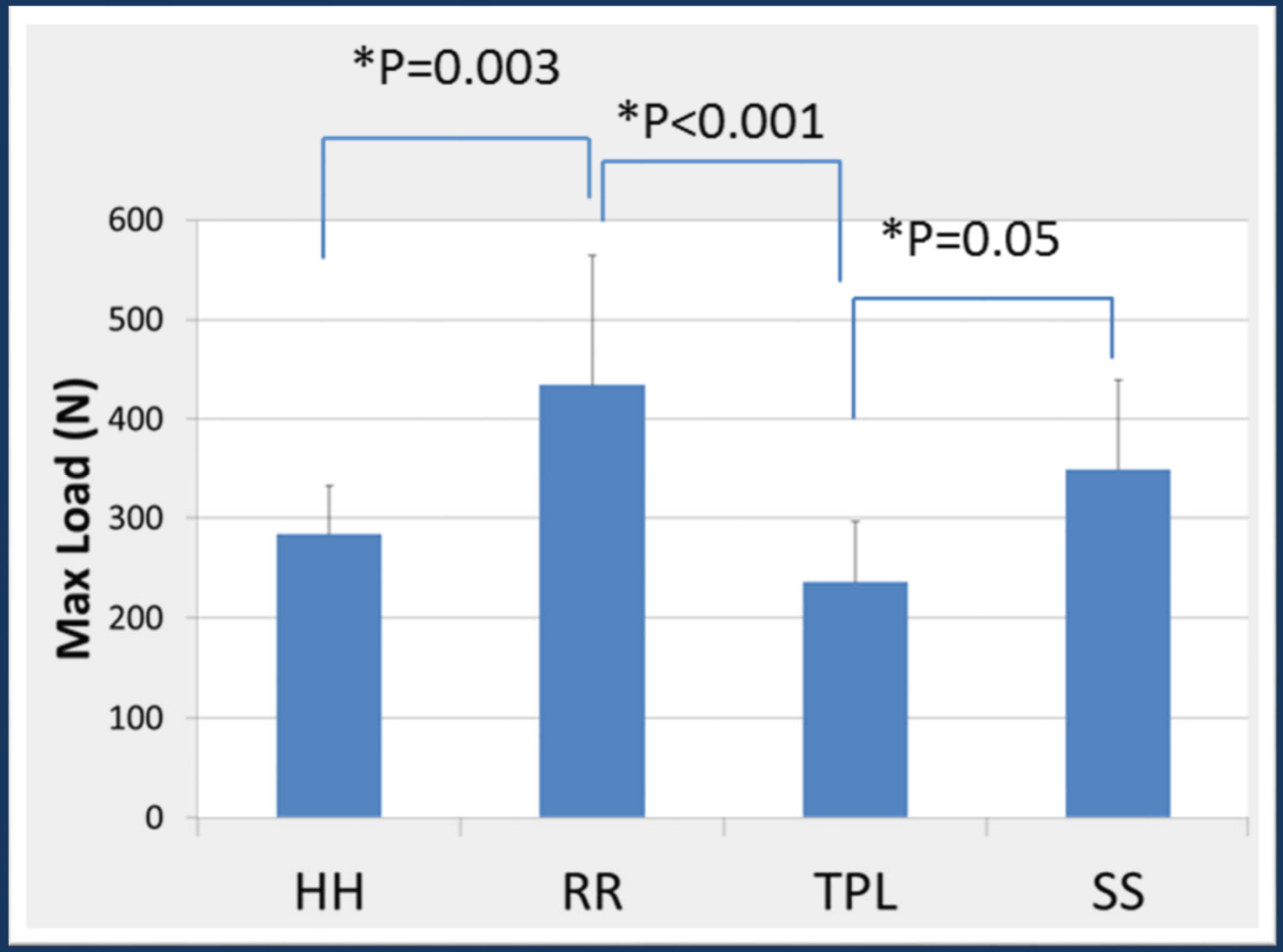
- All specimens eventually failed at the bone-anchor interface. No failures were observed in the instrumentation utilized.

Construct Type	Maximum load for failure (Mean & Standard Deviation)
(Screw-Screw) SS	349 ± 89 N
(Laminar Hook-Hook) HH	283 ± 48 N
(Rib Hook-Hook) RR	429 ± 133 N
(Transverse Process-Laminar Hook-Hook) TPL	236 ± 60 N

- Young's Modulus was calculated for each construct type and no statistically significant difference was determined.

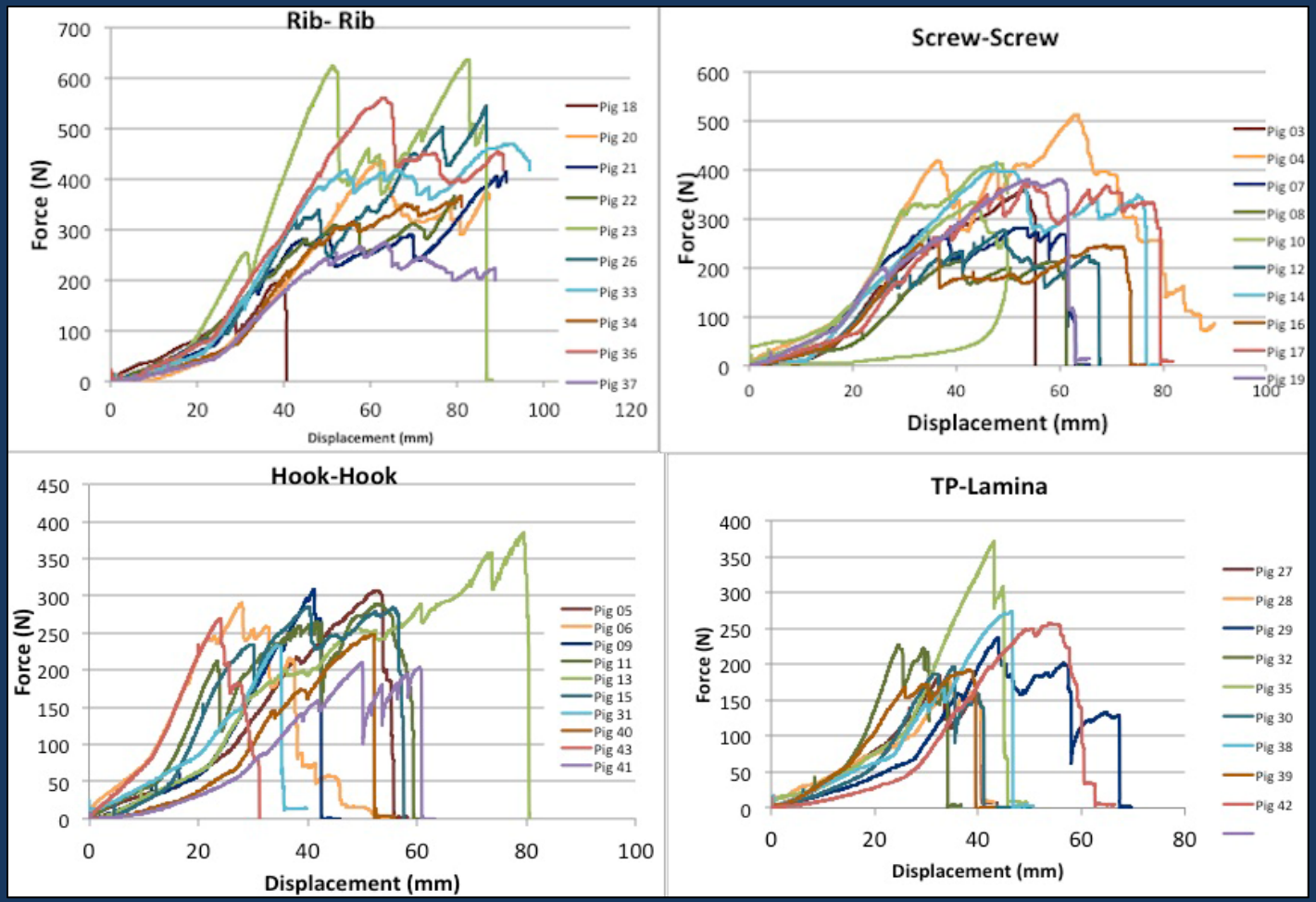
Results

- Maximum load to failure was significantly different in RR/HH, RR/TPL and SS/TPL construct pairs:



Results

- While RR and SS had the highest load to failure they had the most variable results too.



Conclusion

- Our study shows with posteriorly applied loads, Rib Hooks and Spine Screws failed at the highest ultimate loads; however, with greatest variability among the foundations tested.

- Spine Hooks and Transverse Process-Laminar Hooks had lower ultimate strengths but were less variable.

Significance

- Rib hooks may be considered as an alternative in upper foundation constructs in Growing Rod techniques.

Thank You!