BIOMECHANICAL STUDY SUMMARY

The Role of Sacral Slope in Lumbosacral Fusion: A Biomechanical Study

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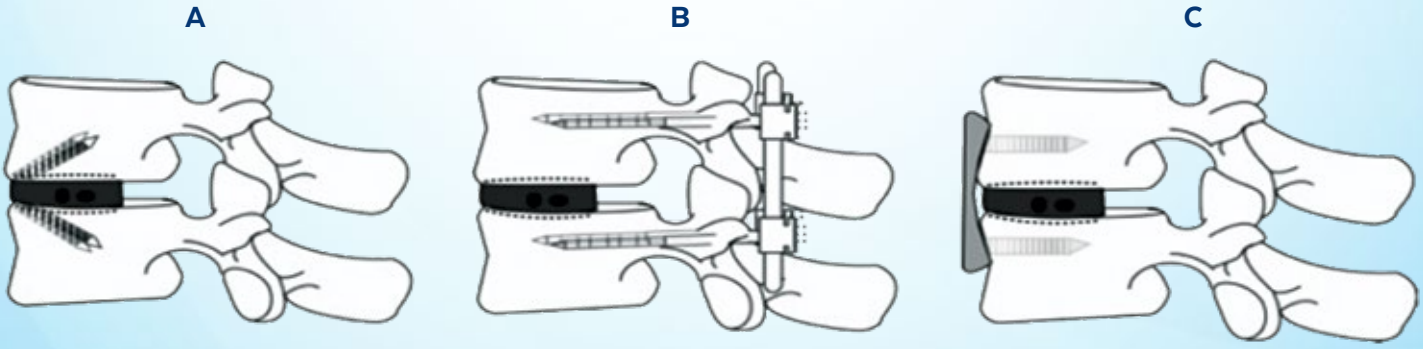
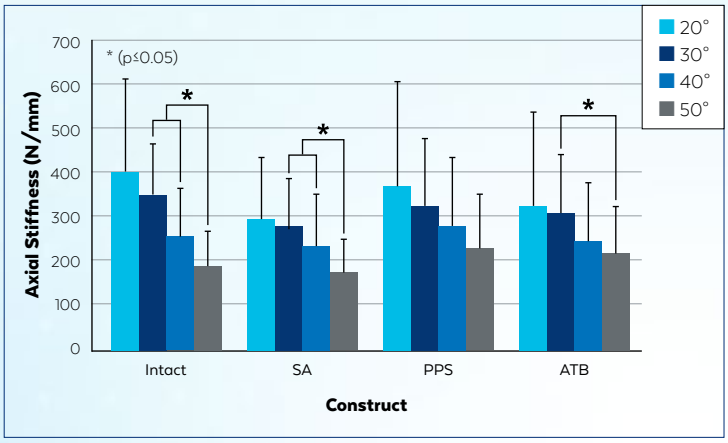
OBJECTIVE: Abnormal sacral slope (SS) has been shown to increase progression of spondylolisthesis; however, its role in the correction of adult spinal deformity, its influence on lumbosacral shear, and its impact on the instrumentation selection process are scarcely known. The aim of this biomechanical study was to investigate the effect of SS on three anterior lumbar interbody fusion constructs.

METHOD: Nine healthy, fresh-frozen, intact human lumbosacral vertebral segments were tested by applying a 550N axial load to specimens with an initial SS of 20° on an MTS Bionix test system. Testing was repeated as SS was increased to 50°, in 10° increments, through an angulated testing fixture. Specimens were instrumented using the INDEPENDENCE® Stand-Alone ALIF Spacer (SA), CONTINENTAL® ALIF Spacer with posterior pedicle screws (PPS), and CONTINENTAL® ALIF Spacer with anterior tension band plate (ATB) in a randomized order. Stiffness was calculated from the linear portion of the load-deformation curve. Ultimate strength was also recorded on the final construct of all specimens (n=3 per construct) with an SS of 40°.



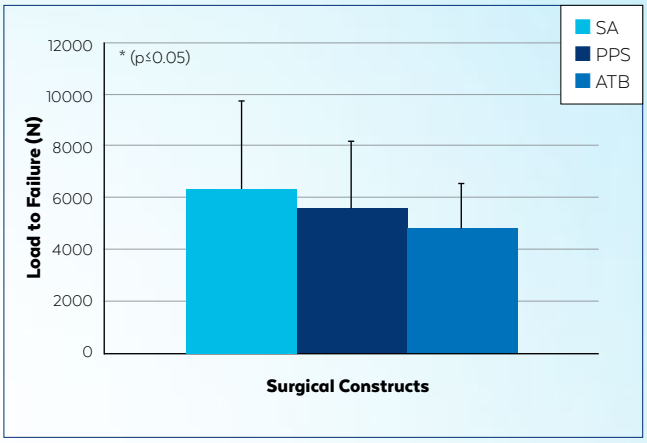
A. INDEPENDENCE® Stand-Alone ALIF Spacer **B.** CONTINENTAL® ALIF Spacer with posterior pedicle screws
C. CONTINENTAL® ALIF Spacer with anterior tension band plate and screws

Mean and standard deviations of L5-S1 axial stiffness measurements for surgical constructs across sacral slope angles



Statistically significant differences within surgical construct comparisons are indicated (*) (P < 0.05).

Mean load to failure of L5-S1 surgical constructs at a sacral slope of 40°



No statistically significant difference between constructs is indicated (all comparisons P < 0.05).

RESULTS:

- Axial compression across the disc space decreased with increasing SS, indicating that SS beyond a 40° threshold shifted L5–S1 motion into pure shear, instead of compression shear, defining a threshold.
- Trends in ultimate load and displacement differed from linear stiffness, with SA > PPS > ATB.

INDEPENDENCE®
Stand-Alone ALIF Spacer

CONCLUSION:

In this study, at larger SS, bilateral pedicle screw constructs with spacers were the most stable. INDEPENDENCE® has the highest load to failure, which may be due to angulations of integrated plate screws. Increasing sacral slope significantly reduced stiffness, which suggests that more aggressive fixation techniques should be considered for a high sacral slope when rigid fixation of the lumbosacral junction is required.

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