Multi-planar MIS lateral Lumbar Fusion Construct Stability Using a Combination of Lateral and Spinous Process Plating: Equivalence to Bilateral Pedicle Screw Fixation?

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Introduction: Previous testing has shown the high biomechanical stability of the XLIF approach interbody cage alone compared with the intact spine. The 2-bolt lateral plate has been shown to add stiffness in lateral bending and axial rotation, but little change in flexion-extension. The stability offered by the spinous process plate should reduce motion in the flexion-extension plane, and therefore a combination of lateral and spinous process plates may increase stability in all directions; potentially to the extent of bilateral pedicle screws.

Methods: Ten spines (L1-L5) were subjected to multidirectional non-destructive flexibility testing. Each spine was tested under the following conditions: (1) intact, (2) L3-4 discectomy with interbody cage, (3) lateral plate, (4) lateral + spinous process plates, (5) spinous process plate, (6) ipsilateral pedicle screws, (7) bilateral pedicle screws. ROM was evaluated and normalized to intact. Differences were examined using repeated-measures ANOVA and Holm-Sidak comparisons.

Results: The interbody cage alone significantly reduced ROM in all directions with respect to intact. Bilateral screws provided the most rigid supplemental fixation. The lateral plate was not significantly different from the cage alone in flexion-extension, but was more rigid in lateral bending and axial rotation. The spinous process plate significantly improved flexion-extension rigidity over standalone, but was not significantly more rigid in lateral bending or axial rotation. The addition of the spinous process plate to the lateral plate combined to reduce motion in all planes, providing rigidity statistically equivalent to bilateral pedicle screws.

Conclusion: The lateral plate was significantly more rigid than the cage alone in lateral bending and axial rotation, while the spinous process plate was significantly more rigid in flexion-extension. The combination of both plates provided improved rigidity in all directions that was statistically equivalent to bilateral pedicle screws.

Significance: The clinical question is how much rigidity is necessary to prepare the best environment for interbody fusion. This study demonstrates the increased rigidity of supplemental fixation including the combination of lateral and spinous process plates.