In Vitro

Biomechanical Evaluation of a Lateral Lumbar Interbody Fusion Cage with Integrated Lateral Modular Plate Fixation

Lead Investigators
R. DenHaese,[1] A. Gandhi,[2] C. Ferry,[2] S. Farmer,[2] R. Porter,[3]

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A biomechanical evaluation was performed on a lateral lumbar interbody fusion (LLIF) cage possessing lateral modular plate fixation (MPF) (Timberline MPF Lateral Fusion System – Highridge Medical, Figure 1.)

The integrated MPF technology, which has yet to be explored in a lateral interbody fusion model, improves vertebral body stabilization during initial cage placement, ensures physiological cage compression, and affords robust bicortical vertebral purchase while preserving the endplates. Given such inherent stabilization capabilities, it is proposed that the LLIF/MPF cage can diminish the need for extensive invasive posterior fixation. Accordingly, it is hypothesized that the LLIF/MPF cage supplemented with minimally disruptive interspinous process fixation (ISPF) can afford comparable or favorable segmental stability to that of a traditional LLIF cage with supplemental bilateral pedicle screw fixation (BPSF)

Fig. 1 Timberline® MPF Lateral Fusion System, 2-Screw (Left) and 4-Screw (Right)

Study Objective

The objective of this study was to compare the biomechanical stability of the LLIF/MPF construct with supplemental ISPF to that of a traditional LLIF cage with supplemental PSF.

Study Methods

Specimen Preparation

Seven human cadaveric spines (L1-L4) were tested. Osseous integrity was confirmed via DEXA scals and radiographs. The L1 and L4 vertebral bodies were potted. Each spine was first tested in an intact state. A lateral discectomy (L2/L3) was then performed, followed by ineractive construct instumentation and testing.

Testing Protocol:

A 7.5Nm moment was applied in flexion/extension (FE), lateral bending (LB), and axial rotation (AR) using a six degree-of-freedom kinematics system. Segmental range-of-motion (ROM) was tracked using a motion analysis system. Mean ROM reduction and segmetl lordosis following fixation was measured

Testing Sequence:

1. Intact Spine
2. Timberline MPF + ISPF (Alpine XC Adjustable Fusion System) (Figure 2)
3. Lateral Cage BPSF (Figure 3)

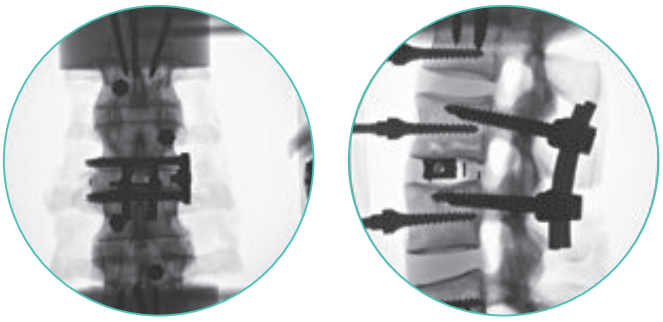

Fig. 2 *Timberline® MPF Cage with 4-Hole Plate + Rigid Interspinous Fixation (Alpine XC™ Adjustable Fusion System)*

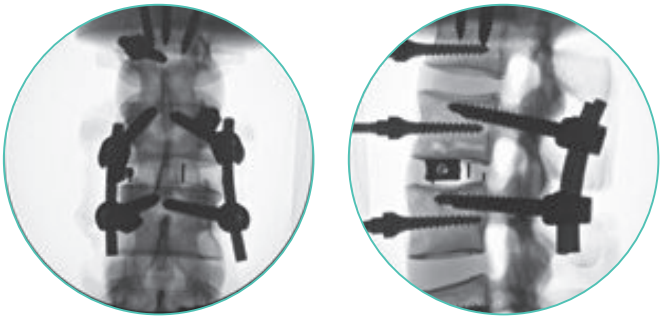

Fig. 3 *Traditional LLIF Cage + Bilateral Pedicle Screw Fixation (Anteroposterior – Left; Lateral – Right) (Anteroposterior – Left; Lateral Right)*

Results

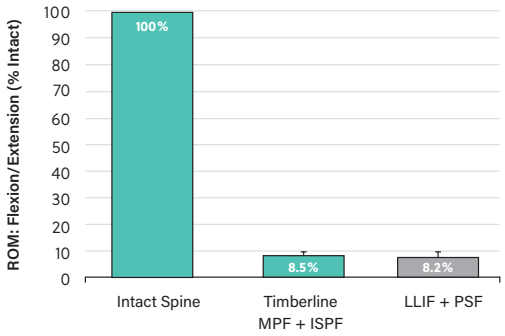

Fig. 4 *Flexion/Extension ROM*

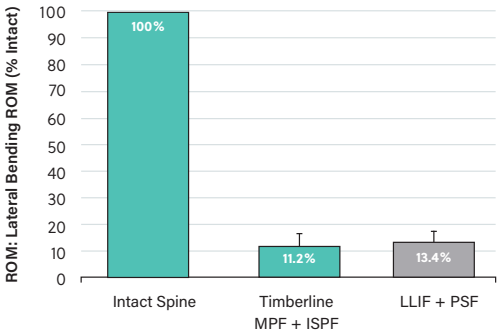

Fig. 5 *Lateral Bending ROM*

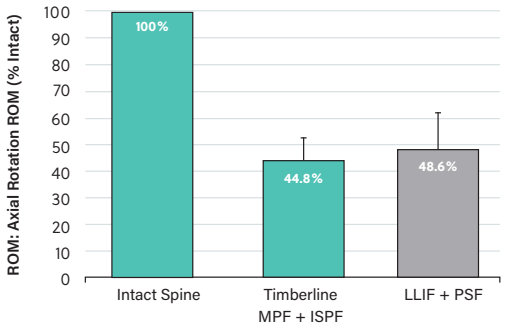

Fig. 6 *Axial Rotation ROM*

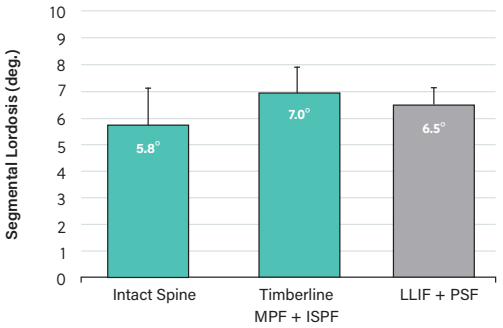

Fig. 7 *Segmental Lordosis (deg.)*

CONCLUSION

The LLIF cage with integrated MPF (4-screw), when supplemented with interspinous process fixation, can provide robust motion reduction in all principle directions; comparing favorable to a traditional LLIF cage augmented with supplemental bilateral PSF.

References

1. AXIS Neurosurgery, Williamsville, United States,
2. ZimVie Spine, Broomfield, United States,
3. Barrow Neurological Institue, Phoenix, United States

†. DenHaese RP, Gandhi A, Ferry C, Farmer S, Porter R. In-Vitro Biomechanical Evalution of a Lateral Lumbar Interbody Fusion Cage with Lateral Modular Plate Fixation. European Academy of Neurosurgeons Annual Meeting, Oct 2015, ePoster Presentation.

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