INTRODUCTION:
Traditional posterior pedicle screw fixation is well established as the standard for spinal stabilization following interbody and/or posterior lumbar fusion. In patients with lumbar spinal stenosis requiring segmental posterior instrumented fusion and decompression, Interlaminar Lumbar Instrumented Fusion (ILIF) is a potentially less invasive alternative with reduced morbidity that includes direct decompression assisted by an interlaminar/interspinous allograft spacer stabilized by a spinous process plate. In this current study, a biomechanical evaluation of the ILIF procedure was performed using a 'hybrid' testing protocol in a multi-segmental cadaveric model and was compared with traditional posterior surgical approaches used clinically today for stabilization of the spine. No previous biomechanical study on this technique has been conducted.

METHODS:
A sample of eight fresh-frozen human lumbar cadaveric specimens were acquired and studied. (age range 49-64, mean 56.1 years; all male). Bilateral pedicle screws of appropriate size to fit the individual specimen anatomy were implanted at the L3 and L4 vertebrae; initially without connecting rods. Specimens were subjected to non-destructive multi-directional testing at the L3-L4 vertebral segment using a custom-built 6 degree-of-freedom (DOF) spine testing system. Three cycles of pure-moment flexion-extension, lateral bending and axial rotation were performed, with data evaluation from the 3rd cycle. After testing the intact spine to ±7.5 Nm, subsequent conditions were constructed at L3-4 and compared to the intact ROM: bilateral pedicle screws (bPS), bilateral laminotomy, ILIF(bilateral laminotomy+allograft+spinous process plate), wide laminectomy, wide laminectomy+unilateral pedicle screws (wL+uPS), wide laminectomy+bilateral screws wL+bPS, Gill laminectomy(Gill), Gill laminectomy+bilateral screws(Gill+bPS).

RESULTS:
Bilateral pedicle screws without any destabilization was the most rigid condition. In flexion-extension, the condition with the greatest mean limitation in range of motion (ROM) was bPS at 1.42°, although no statistically significant difference existed when compared to ILIF at 1.79° (p = 0.942), wL+bPS at 1.49° (p = 0.995) and Gill+bPS at 1.43° (p = 0.968) (Fig 2). ILIF provided 365% stiffness of the intact spine and no significant difference was detected between ILIF and wL+bPS or Gill+bPS.

DISCUSSION:
In the present study, biomechanical stability of a Hibbs style interlaminar fusion with adjunctive spinous process fixation (Interlaminar Lumbar Instrumented Fusion) was investigated in a cadaveric model. Biomechanical testing demonstrated that the ILIF technique significantly reduced motion, particularly in flexion-extension, when compared to the normal spine. In flexion-extension, ILIF was statistically not different to bilateral pedicle screws. In lateral bending, ILIF was not different to wide laminectomy with unilateral pedicle screws. In axial rotation, ILIF was not different from wide laminectomy with unilateral pedicle screws or Gills laminectomy with bilateral pedicle screws.

Biomechanical testing has indicated that the ILIF technique is a viable alternative for rigid fixation of the destabilized spine. It provides comparable stability to bilateral pedicle screw instrumentation but without risks, such as neurological injury. The ILIF technique allows surgeons to perform minimally invasive single-approach posterior decompression, fusion and fixation without the added morbidity of traditional pedicle screw fixation and posterolateral fusion.