Biomechanical Study of the Effects of Variable Screw Lengths & Diameters Using FacetFuse Transfacet Pedicle Fixation in the Upper & Lower Lumbar Spine*

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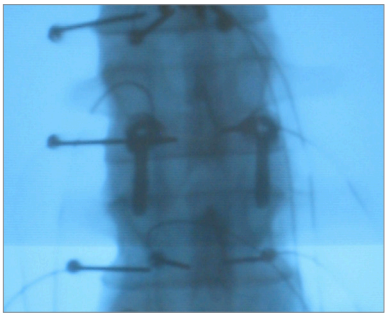

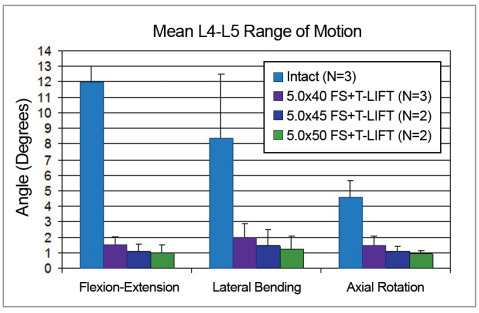

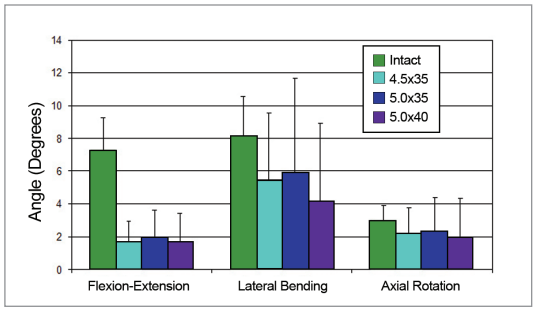

Background Context

There is limited knowledge to guide improving fixation of transfacet pedicular screw fixation (FF) in the upper and lower lumbar regions. No previous study has examined the biomechanical consequence of increasing screw length and diameter.

Purpose

The goal of this in vitro study was to determine the extent to which greater screw diameter (in the upper lumbar region) and greater screw length (in the upper and lower lumbar regions) give greater FF stability.

Study Design/Setting

Paired comparisons of flexibility in cadaveric specimens instrumented with FF at multiple levels.

Patient Sample

Six human cadaveric T12-S1 specimens were studied. Data were obtained for 6 upper lumbar motion segments (L1-2 or L2-3) and 3 L4-L5 motion segments.

Outcome Measures

Mean range of motion during flexion, extension, axial rotation, and lateral bending were compared in multiple conditions using RM-ANOVA/Holm-Sidak tests.

Methods

Specimen flexibility was tested by applying nonconstraining nondestructive pure moments (7.5 Nm maximum) while recording specimen motion optoelectronically in 3D. Specimens were tested first intact, then, in the upper region, after trans-psoas interbody fixation (S-LIFT) and (A) insertion of 4.0x35mm FF (with washer) at L1-2 or L2-3, (B) after replacing with 5.0x35mm FF, and (C) after replacing with 5.0x40mm FF. In the lower lumbar region, specimens were tested after transforaminal interbody fixation (T-LIFT) and (A) 5.0x40mm FF at L4-5, (B) 5.0x45mm FF, and (C) 5.0x50mm FF.

Results

In the upper lumbar region, the mode of loading with the least consistent reduction in ROM was lateral bending. In all three modes of loading, a longer screw provided slightly reduced ROM whereas a larger diameter had no beneficial effect. Comparisons did not reach significance. In the lower lumbar region, longer screws consistently limited ROM better, although statistical significance was not reached.

Discussion & Conclusion

This study confirms that screw length is a viable factor in optimizing FF stability in the upper and lower lumbar regions; screw diameter, at least in the upper lumbar region, is a less sensitive parameter and need further analysis. Further studies are needed to understand if the difference in size would become more evident for screws longer than 35 mm and whether the difference also varies between the upper and lower lumbar spine since there was discernible difficulty in the upper lumbar region in precise screw positioning.

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**Pending Publication*

This study was sponsored by the LES Society
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