

## Four-rod Construct is Needed to Maximally Decrease Rod Strain Across Lumbosacral Junction with TLIF but not ALIF in Long Segment Fixation

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### Introduction

Pseudoarthrosis and rod fracture at the lumbosacral junction remain a challenge in long segment fusion, and likely stem from increased lumbosacral strain. Clinical studies have demonstrated the benefit of 4R strategies in three-column osteotomy constructs, but use of multiple rods at the lumbosacral junction has not been extensively studied. Reduction of lumbosacral strain may help reduce fracture rates.

### Methods

Standard nondestructive flexibility tests (7.5 Nm) were performed on 12 cadaveric specimens (L1-ilium) to assess range of motion stability (ROM), rod strain (RS), and sacral screw strain (SS) of four-rod condition (+4R) versus two-rod condition (+2R) (Fig 1); specimens were equally divided into either an L5-S1 ALIF or L5-S1 TLIF group. 5 conditions were tested: 1) noLIF+2R, 2) ALIF+2R and 3) ALIF+4R, or 4) TLIF+2R and 5) TLIF+4R. Data were analyzed using RM-ANOVA or ANOVA ( $p < 0.05$ ).

### Results

In both ALIF and TLIF, 4R and 2R provided significant decrease in ROM, RS, and SS compared to noLIF+2R in flexion (F), extension (E), and compression (C,  $p < 0.026$ ). No significant difference was observed between ALIF+4R and ALIF+2R ( $p > 0.113$ ), or TLIF+4R and TLIF+2R in ROM or SS ( $p > 0.182$ ); TLIF+4R demonstrated significant reduction in RS compared to TLIF+2R in C and E ( $p < 0.026$ ), while ALIF+4R and ALIF+2R were equivalent. ALIF+2R demonstrated greater reduction in RS than TLIF+2R in E and C ( $p < 0.025$ ). No significant differences were observed between ALIF+2R and TLIF+4R in ROM, RS, or SS in F and E ( $p > 0.112$ ); RS neared significance in C ( $p = 0.05$ ).

### Conclusions

Although ALIF+2R provides greater strain reduction across the lumbosacral junction than TLIF+2R, use of 4R fixation with TLIF can nullify the difference in strain between LIF conditions.

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### References

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### Learning Objectives

By the conclusion of this session, participants should be able to: 1) describe the importance of rod and screw strain in construct design and how they contribute to instrumentation failure, 2) describe the differences between anterior or posterior interbody placement on rod and screw strain in long segment fusion, 3) understand the benefit that is associated with multiple rod use in construct using posterior interbodies (TLIF) compared with those using an anterior interbody (ALIF).

#### Rod Strain (RS) in Two- and Four-Rod Configurations with either TLIF or ALIF

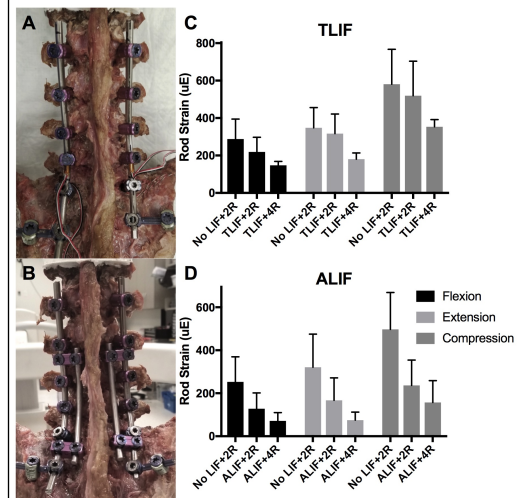


Diagram of two rod (A) and four-rod (B) construct across the lumbosacral junction. Graph of Rod strain (uE) in TLIF (C) and ALIF (D) demonstrate the benefit of four rods in the TLIF construct compared to the ALIF construct.