Segmental Kinematics before and after Lumbar TDR: A Prospective Randomized Study Comparing Unconstrained, Semi-constrained, and Constrained Implants

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Introduction: Segmental motion is quite variable among symptomatic individuals. While some patients with symptomatic discogenic pain demonstrate relative immobility at the affected segment, others demonstrate hypermobility/instability. Appropriate selection of lumbar TDR may be related to proper matching to the patients segmental motion. Implant design may affect in-vivo motion following lumbar TDR, and post-operative motion may be related to implant design and not to patients variables.

Purpose: The purpose of this study was to demonstrate the segmental motion characteristics of 3 different implant designs (ie unconstrained, semi-constrained, and constrained).

Methods: All patients enrolled in a FDA IDE study comparing 3 different lumbar TDR implants were included in the study. All data was collected prospectively. All patients met inclusion criteria, including single level symptomatic disc disease at either L4/5 or L5/S1. Patients were randomized to either the investigational group (semi-constrained), or to the control group (unconstrained or constrained). All patients had a retroperitoneal approach by an approach surgeon, and disc replacement by a orthopedic spine surgeon.

Results: 162 patients were included in this study. Motion was measured in degrees. Overall the average ROM was 6.5 pre-operatively and 5.7 at 12 months.

The average ROM at 12 months was: 6.1 for unconstrained, 5.9 for semi-constrained, and 4.5 for constrained.

Overall the average ROM at 12 months at L4/5 was 6.1, while at L5/S1 was 5.5.

The average ROM at 12 months at L4/5 was 5.8 for unconstrained, 6.6 for unconstrained, and 4.5 for constrained.

The average ROM at 12 months at L5/S1 was 6.3 for unconstrained, 5.6 for semi-constrained, and 4.5 for constrained.

The average ROM of the adjacent level was 6.7 preoperatively and 7.3 at 12 months for all 3 groups combined. The average ROM of the adjacent level at 12 months for the 3 groups were 8.7 for the unconstrained, 7.4 for the semi-constrained, and 5.7 for the constrained.

Conclusions: The results of our study demonstrate that in general lumbar TDR restores preoperative ROM regardless of implant design. However, our results also suggest that implant design does tend to affect adjacent level kinematics with unconstrained implants associated with increased adjacent level motion, and constrained implants associated with decreased adjacent level motion.