Lumbar Lordosis Redistribution and Segmental Correction in Adult Spinal Deformity: Does it Matter?

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INTRODUCTION: Spinal realignment for adult spinal deformity (ASD) is an evolving science. Recent data outlining ideal targets for each lumbar lordosis segments has been published, however, little is known whether those targets impact clinical outcomes. The aim of this study is to evaluate if correction of lumbar lordosis to segmental ideals restores spinal shape and prevents mechanical complications.

METHODS: A total of 510 patients who underwent ASD surgery with upper instrumented vertebra (UIV) between T4-L1, lower instrumented vertebra (LIV) at ilium and baseline (BL), and 2-year follow up (2yr) radiographs and PROMs were retained for analysis. PI adjusted segmental lordosis were extracted from recent literature, Charles and Pesenti et al (Table). Postoperative offset from normative values were calculated. Patients were grouped based on offset to overcorrected (OVER), (MATCH) within 10% of mean offset, and undercorrected (UNDER). OVER/UNDER at L4-S1 and T10-L2 also examined. Surgical strategies (3CO, IBF), PROMs (ODI, VR12, and PROMIS), radiographic and implant related complications, and revisions across groups compared.

RESULTS: Postoperative L4-L5, L5-S1, and L4-S1 were OVER in 38%, 34%, and 35% of pts. T10-L2 and L2-4 were OVER in 45% and 46% of pts. Overall, 14.9-33.5% of pts were matched to ideal segmental lordosis at any level. At 2yr, PJK rate in the T10-L2 groups were 28.9% for OVER, 9.3% in MATCH, and 13.2% of UNDER, $p<0.001$. Similarly, L2-L4 groups (25.2 vs. 12 vs. 15.9%, $p<0.05$). Patients who were UNDER vs. OVER in both T10-L2 and L4-S1 had greater rate of revision for implant related complications 18.6 vs. 7.8%, $p<0.05$; specifically rod breakage 21.6% vs. 12.7%. Patients who were OVER in proximal lordosis and T10-L2 segments had greater junctional zone posterior inclination (-12.5° vs. -8.3° vs. -7.2 °, $p<0.05$) with 76% of proximally OVER patients having UIV posterior inclination of > -10°. In total, 59.4% of patients with laterally placed IB were OVER at T10-L2 vs. 42.3% in ALIF, $p<0.05$. PROMs were comparable between correction groups at 2yr. OVER at L4-S1 did not achieve better outcomes vs. MATCH, but both had better outcomes vs. L4-S1 UNDER (ODI: 25 vs. 27.5 vs. 32.1, $p<0.05$).

DISCUSSION AND CONCLUSION: Overcorrection of segmental lordosis based on PI-adjusted ideas led to higher rates of PJK at 2yr. Undercorrection led to more revisions for implant failure (i.e., rod breakage). Proximally and laterally placed interbodies were more likely to overcorrect the thoracolumbar junction; these groups were more likely to sustain a PJK.

PI Category	*PI*	T10-L2	L1-L2	L2-L3	L3-L4	L4-5	L5-S1
Low	*40*	-6.9	1.4	5	10	15	20
Avg	*50*	-4.3	2.3	6.5	10	15	17.5
Avg	*60*	-4.3	2.3	6.5	10	15	17.5
High	*70*	2.1	4.9	9.6	12	15	18
High	*80*	2.1	4.9	11.2	14	17.5	21
HIGH	*90*	2.1	4.9	12.8	16	20	24