Contemporary Utilization of Three-Column Osteotomy Techniques in a Prospective Complex Spinal Deformity Multicenter Database: Implications on Full-Body Alignment and Perioperative Course

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INTRODUCTION: Research has focused on the increased correction from a three-column osteotomy (3CO) during adult spinal deformity (ASD) surgery. However, an in-depth analysis on the performance of a 3CO in a cohort of complex spinal deformity cases has not been described. The purpose of this study is to determine if three-column osteotomies demonstrate superior benefit in correction of complex sagittal deformity at the cost of increased perioperative complications.

METHODS: Included**:** surgical complex ASD pts. Thoracolumbar 3COs compared to No 3CO(remaining cohort). Rigid deformity: ΔLL less than 33% from standing to supine. Severe deformity: Global(SVA>80mm), Lumbopelvic (PI-LL>30°). Means comparison tests assessed correction by 3CO grade/location. Multivariate analysis controlling for BL deformity evaluated outcomes up to six weeks compared to No 3CO.

RESULTS:

249 patients included (Levels Fused: 12.6±3.8). 51 were 3CO, a 20% higher usage than historical cohorts. 3COs were older, frail, and more likely revision (OR: 5). 3COs were more likely to present with both Severe global/lumbopelvic deformity (OR: 4), 48% being rigid. 3COs had greater use of secondary rods (OR: 4), incurring 4 times (4x) greater risk for: massive blood loss (>3500mL), longer LOS, SICU admission, periop wound and spine-related comps, and neuro comps when performed below L3. 3COs had similar HRQL benefit, but higher periop opioid use. Mean segmental correction increased by grade (G3 – 21; G4 – 24; G5 – 27), 4x greater than low-grade osteotomies, especially below L3 (OR: 12). 3COs achieved 2x greater spinopelvic correction. Higher grades properly distributed lordosis 50% of the time except L5. Pelvic compensation and non-response were relieved more often with increasing grade, with greater correction in all LE parameters (p<.01). Due to increased complication, 3COs trended towards higher periop cost ($42,806 vs. $40,046, p=.086).

DISCUSSION AND CONCLUSION: Three-column osteotomy usage in contemporary complex spinal deformities is generally limited to more disabled individuals undergoing the most severe sagittal and coronal realignment procedures. While there is a perioperative cost and prolongation with usage, these techniques represent the most powerful realignment techniques available with dramatic impact on normalization at operative levels and reciprocal changes.

Grade	T10	T11	L1	L2	L3	L4	L5	Total
G3 (15 pts)	-	-	-	28.4°	16.6°	19.1°	-	20.5°
G4 (23 pts)	-	12.8°	23.6°	20.5°	22.2°	25.3°	25.7°	23.4°
G5 (3 pts)	17.0°	-	27.9°	34.9°	-	-	-	26.6°