Surgeon Contoured Versus Precontoured Patient-Specific Rods in Adolescent Idiopathic Scoliosis: Assessing Global Sagittal Alignment

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INTRODUCTION:

Surgery for adolescent idiopathic scoliosis (AIS) typically involves posterior spinal fusion (PSF) using rods contoured by the surgeon, which may be time-consuming and may not reliably restore optimal sagittal alignment. Thus, the use of artificial intelligence (AI) and preoperative planning software to develop precontoured patient-specific rods to restore spinal alignment has become popular. This study compares radiographic, surgical, and patient-reported outcomes (PROs) of AIS patients treated with surgeon contoured or precontoured rods.

METHODS: This is a retrospective review of prospectively collected data of two consecutive groups of AIS patients who underwent PSF with surgeon contoured or patient-specific rods. Patient demographics, number of fused levels, estimated blood loss (EBL), and surgical time were obtained via chart review. Radiographic measurements including coronal cobb angle, T5-T12 thoracic kyphosis, lumbar lordosis (LL), pelvic incidence (PI), PI-LL mismatch, and T1 pelvic angle (TPA) were obtained pre- and postoperatively. Adaptive spine intelligence software was utilized to predict postoperative sagittal alignment which was compared with observed measurements. SRS-22 quality of life questionnaire was obtained at 3, 6, 12, and 24 months postoperatively. Statistical analysis using two-sided and paired t-tests were performed to determine significance.

RESULTS: Fifty-nine patients were included in this study, with 41 in the surgeon contoured cohort and 18 in the precontoured cohort. No significant differences were noted between the two cohorts with regard to gender, demographic characteristics, number of fused levels, EBL, surgical time, and overall SRS-22 scores at last follow up. In total, 100% of patients with precontoured rods vs. 85% of patients with surgeon contoured rods had a postoperative thoracic kyphosis between 20-40 degrees (p= 0.5412). Some 36.6% of patients with surgeon contoured rods were found to have a PI-LL mismatch within 10 degrees postoperatively vs. 66.7% in patients with precontoured rods (p=0.0358). Other radiographic measurements were similar between cohorts. Average differences between AI predicted and observed values for the precontoured group were 5.2 for T5-T12 thoracic kyphosis (*p=0.0102)*, 10.7 for LL (*p=0.0007)*, 11.1 for PI-LL mismatch *(p=0.0005*), and 0.11 for TPA (p=0.8842).

DISCUSSION AND CONCLUSION:

The use of AI and patient-specific precontoured rods may help predict global sagittal balance and achieve more optimal kyphosis restoration and PI-LL mismatch than surgeon contoured rods in AIS patients undergoing PSF. Further studies with greater power and long-term follow up are needed to corroborate these findings and follow the relationship of these sagittal parameters to PROs.

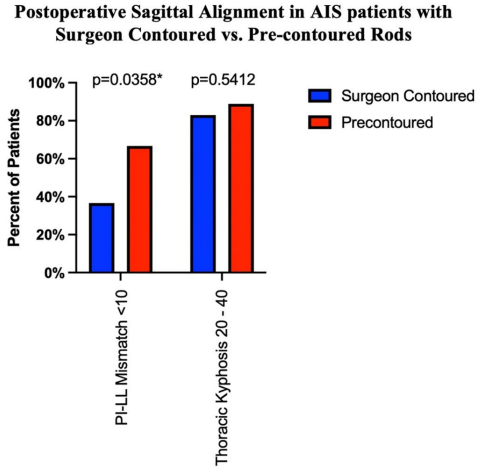

Figure 1 Percentage of patients with postoperative PI-LL mismatch within 10 degrees and thoracic kyphosis within 20-40 degrees for surgeon contoured and pre-contoured rods cohorts