

# Analysis of radiographic parameters reveals differences in outcomes when comparing patient-specific short rod constructs to conventional rods



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## Introduction

Patient-specific spine rods (PSSRs) are pre-contoured custom rods manufactured based on preoperative spinopelvic parameters and postoperative alignment goals. Recent studies have indicated that these rods can improve surgical correction for long segment adult spinal deformity constructs. However, few studies have investigated the impact these rods have on short segment lumbar fusion for degenerative conditions. In this analysis, we aimed to determine how the use of patient-specific spine rods (PSSR) affect radiographic parameters and categorical outcomes when compared to conventional rods.

## Methods

This study is a retrospective cohort study comparing the use of PSSRs to conventional spine rods for degenerative lumbar fusions. Fifty patients at a single institution underwent primary lumbar fusion with PSSR and were compared to a historical cohort of patients from a study published by Leveque et al. Pelvic incidence (PI) and lumbar lordosis (LL) were measured and patients were divided into four categories (*preserved, restored, not corrected, and worsened*) based on pre- and postoperative measurements of PI-LL. Statistical analysis was performed using ANOVA tests and one and two sample t-tests.

## Results

Patients undergoing spinal fusion with PSSRs had a significant difference in the average pre- and postoperative PI-LL change ( $-4.2^\circ$ ) as opposed to the non-PSSR historical cohort of patients ( $-0.1^\circ$ ,  $p$ -value  $< 0.001$ )

Postoperative analysis of spinopelvic parameters in the PSSR patients placed 37 patients (74%) in the preserved category, 9 patients (18%) in the restored category, and 2 patients each in the not corrected (4%) and worsened (4%) categories

A greater proportion of patients in the PSSR sample were in the preserved group (74% vs 63.5%,  $p$  value 0.1825). More patients in the PSSR group had restored spinopelvic parameters after surgery (18% vs 8.7%,  $p$  value 0.05) and fewer patients had not corrected parameters (4% vs 21.3%,  $p$  value 0.0059).

The proportion of patients in the worsened category in the PSSR group was slightly lower (4% vs 6.6%,  $p$  value 0.6747)

## Discussion

Many patients have residual pain and disability after lumbar fusion surgery.<sup>1</sup> Researchers in the past four decades have noted the prevalence of complications with straight rod instrumentation in lumbar fusions leading to iatrogenic flatback.<sup>2,3</sup> Thus, there has been an increased attention to the role of spinopelvic parameters in improving health outcomes for patients undergoing lumbar fusion.

The multicenter retrospective study performed by Leveque et al. provided a data set of parameters and outcomes using conventional rods for lumbar fusion, against which we compared our patient population with PSSR. We found a significant difference in average pre- and postoperative PI-LL with the use of PSSRs. Leveque et al. reported a  $p$  value of 0.787 for this same calculation, indicating a lack of a statistically significant difference from pre- to postoperative PI-LL. This suggests that the use of PSSRs in fusion surgery can significantly alter PI-LL, while the use of conventional rods may not produce meaningful postoperative differences in PI-LL.

While both patient groups experienced a decrease in PI-LL, the decrease was significantly different between the Leveque and PSSR groups, with the PSSR group achieving alignment as measured by PI-LL mismatch. This implies that the use of PSSRs may play a role in providing improved postoperative spinopelvic alignment.

PSSRs may be able to better maintain or correct spinopelvic alignment when compared to conventional rods.

Percentage of Patients	Leveque et al.	PSSR	$p$ value
Preserved Group	63.5%	74.0%	0.1825
Restored Group	8.7%	18.0%	0.0567
Not Corrected Group	21.3%	4.0%	0.0059
Worsened Group	6.6%	4.0%	0.6747

Table 1. An evaluation of the categorical distribution of patients was performed between the PSSR and Leveque cohorts in order to compare outcomes

		Post-op	
		Aligned	Malaligned
Preop	Aligned	Preserved 74% (n=37)	Worsened 4% (n=2)
	Malaligned	Restored 18% (n=9)	Not Corrected 4% (n=2)

Figure 1. Division of patients into four categories, based on change in spinopelvic alignment from pre- to postoperative radiographs. Patients were considered malaligned if PI-LL  $\geq 10^\circ$ .

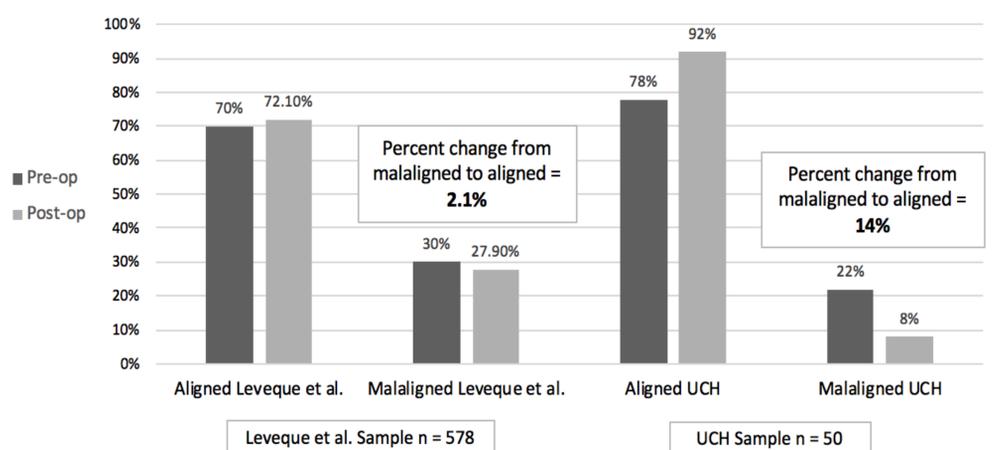


Figure 2. Comparison of alignment distributions pre- and post-operatively with standard rods versus patient-specific rods.

## References

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