

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. Few studies have investigated the impact these rods have on short segment lumbar fusion for degenerative conditions. We aimed to determine how the use of PSSRs affect radiographic parameters and categorical outcomes when compared to conventional rods.

Methods

This is a retrospective cohort study comparing the use of PSSRs to conventional spine rods for degenerative lumbar fusions.

50 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 (Figure 1).

		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 $\geq 10^\circ$.

Results

PSSR fusion patients had a significant difference in average pre- and postoperative PI-LL change, compared to the non-PSSR historical cohort (-4.2° v.s. -0.1° , p-value < 0.001).

Postoperative analysis of spinopelvic parameters in PSSR patients showed (Table 1):

- 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
- 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

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. Categorical distribution of patients from Leveque cohort versus PSSR cohort.

Discussion

Many patients have residual pain and disability after lumbar fusion surgery.¹ Researchers in the past four decades have noted the prevalence of complications with straight rod instrumentation in lumbar fusions leading to iatrogenic flatback and other sub-optimal outcomes.^{2,3} Because spinopelvic malalignment has been associated with lower quality of life in patients who undergo lumbar fusion for degenerative conditions, there has been an increased attention to the role of spinopelvic parameters in improving health outcomes for these patients.⁴

We found a statistically significant difference from pre- to postoperative PI-LL with the use of PSSRs, while there was no difference in the standard rod cohort. 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.

Overall, there was a trend toward improved alignment with PSSRs, as measured by PI-LL mismatch. Patients who received a PSSR had more preservation of alignment, more often restored alignment, and less often had not corrected or worsened postoperative alignment (Figure 2).

Our data suggest that PSSRs may better maintain or correct spinopelvic alignment when compared to conventional rods, thereby producing improved functional outcomes and even improved quality of life.

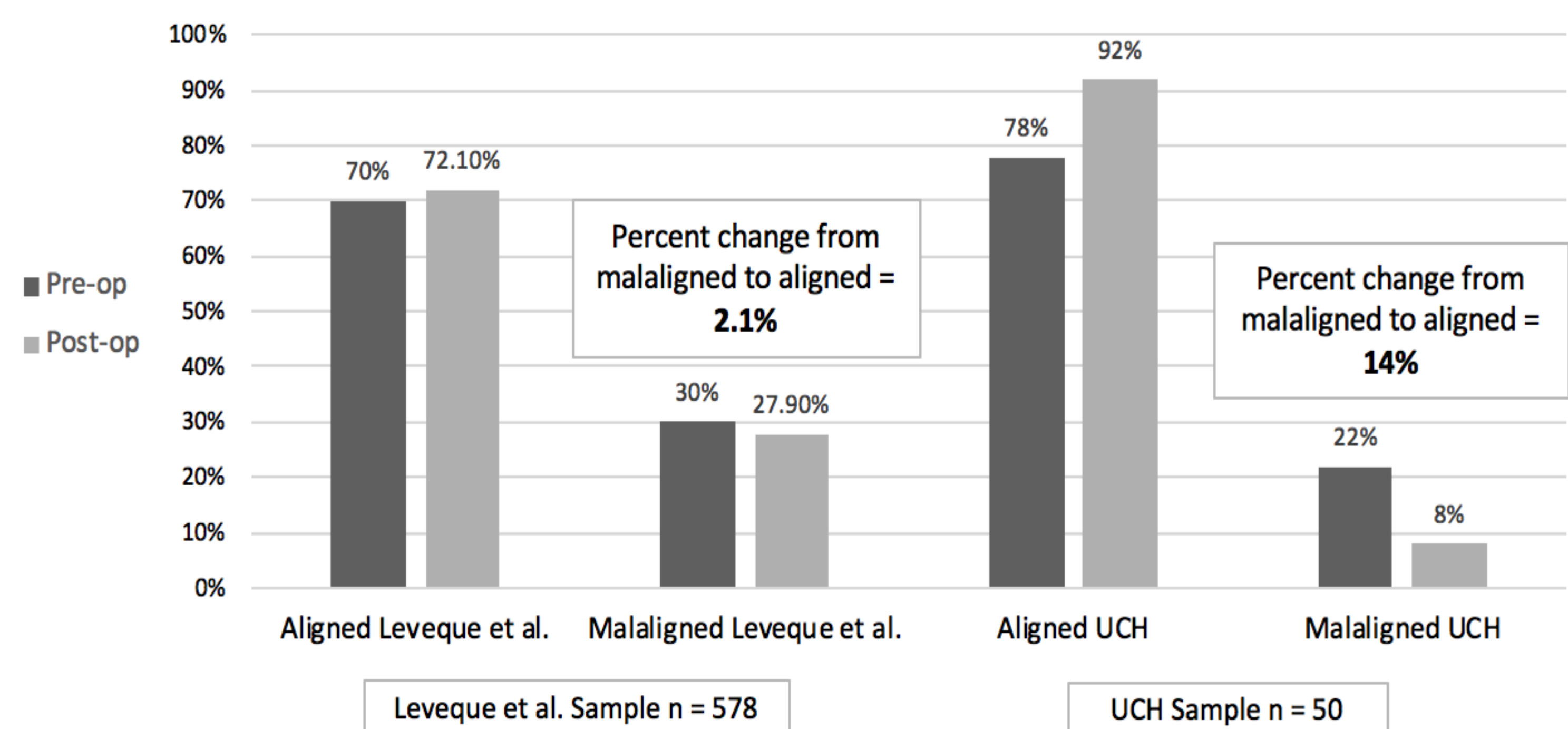


Figure 2. Comparison of alignment distributions (in percentage of patients) pre- and post-operatively with standard rods versus patient-specific rods.

References

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