

Patient specific rods in thoracolumbar kyphoscoliosis surgery protect against proximal junctional failure: a prospective observational study



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Study cohort:

A total of 18 patients:

Mean Age:

70±6.9 years

77% were female



PSR used in thoracolumbar kyphoscoliosis surgery

Background Context

Adult spinal deformity (ASD) is estimated to affect up to 68% of people over the age of 65. Surgical intervention is widely accepted, after non-operative management, to correct the spinal deformity and improve disability. Spinal rods used for thoracolumbar posterior fixation are usually manufactured straight and bent manually during surgery. This manual bending can cause under- or over-correction of the deformity or rod breakage. Pre-bent patient-specific rods (PSR) have been developed with software allowing preoperative deformity correction planning and provide the surgeon with an intraoperative deformity correction consistent with the surgical plan. Notably, there are reduced operation times because PSR do not require contouring during surgery which results in less rod microfractures and decreased fatigue-life

Aim

To report clinical and radiological outcomes using PSR to mid-term follow-up. Specifically, we investigated rates of junctional complications both proximally (kyphosis/failure) and distally (failure).

Study Design and Method

Prospective study of all consecutive patients who underwent ASD surgery with PSR at a single institution between Jan 2019 and June 2020. The minimum follow-up was 2 years. Ethics was obtained. Patients with surgery at >4 levels and thoracolumbar deformity according to the Schwab criteria were included. VAS Back/VAS Leg, ODI, SF-12 (mental/physical), and the Ottawa decision regret questionnaire were evaluated preoperatively, at 6 weeks, 6 months, 12 months and final follow-up postoperatively. Sagittal spinopelvic parameters measured by EOS scans were performed at the same time points reported by independent radiologists.

Results

Eighteen patients underwent PSR within the study period had a mean age of 70 (±6.9) years, 77% were female with a mean BMI of 28 (±5.1) kg/m². Five of 18 patients were ex-smokers. Eleven out of 18 operations were two-stage approaches. All surgeries used titanium 5.5 mm rods without intraoperative bending. No patient exhibited proximal junctional failure (PJF) but 54% of patients demonstrated proximal junctional kyphosis (PJK) at final follow-up. Four patients suffered distal junctional failure (DJF) needing revision surgery. Of these, 3 patients had no L4/5 or L5/S1 interbody cages inserted and 1 patient had a single TLIF cage at L5/S1. No patients suffered DJF with wide footprint cages (ALIF/PLIF) at L5/S1. There was a statistically significant difference in PROMs at 12 and 24-months between the patients that suffered from DJF compared to those without DJF ($p < 0.05$). Three patients reported decisional regret to undergo the PSR surgery with a score of more than 60, they all suffered DJF. The remaining patients reported low regret scores.

Key findings:

No patient in our series experienced PJF and more than half presented with PJK at final follow-up. This rate of PJK is consistent with the literature. This demonstrates PSR as an effective technique to reduce the incidence of PJF in thoracolumbar kyphoscoliosis surgery.

We found impaction of a wide footprint interbody cage at L4/5 (ALIF, PLIF, or LLIF) or L5/S1 (ALIF or PLIF) lowered DJF rates compared to no cage or a single TLIF cage.