ONLINE ONLY
Supplemental material

Multiple-rod constructs and use of bone morphogenetic protein–2 in relation to lower rod fracture rates in 141 patients with adult spinal deformity who underwent lumbar pedicle subtraction osteotomy
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Supplementary Table 1 Univariate Analysis Comparing the Demographic, Surgical, and Radiographic Parameters Between the Non-RF and RF Groups

	Total (n=141)	Without RF (n=79)	With RF (n=62)	P Value
Age at Surgery (Years)	65.2±10.1	66.0±8.5	64.2±11.8	0.311
Gender (No. of Patients)				
Female	92 (65.2%)	51 (64.6%)	41 (66.1%)	0.846
Male	49 (34.8%)	28 (35.4%)	21 (33.9%)	
BMI	29.3±6.0	28.6±6.2	30.3±5.7	0.092
Smoking (No. of Patients)	27 (19.1%)	15 (19.0%)	12 (19.4%)	0.956
Prior Spine Surgeries (No. of Patients)	104 (73.8%)	65 (82.3%)	39 (62.9%)	**0.009**
Rod Configuration (No. of Patients)				
Standard	55 (39.0%)	21 (26.6%)	34 (54.8%)	
Satellite	23 (16.3%)	15 (19.0%)	8 (12.9%)	**0.003**
Nested	63 (44.7%)	43 (54.4%)	20 (32.3%)	
Levels Fused	12.5±3.8	12.7±3.7	12.3±3.9	0.476
Interbody Fusion Adjacent to PSO	79 (56.0%)	44 (55.7%)	35 (56.5%)	0.929
Use of Iliac screws (No. of Patients)	140 (99.3%)	78 (98.7%)	62 (100.0%)	1.000
Use of BMP-2 (No. of Patients)	57 (40.4%)	40 (50.6%)	17 (27.4%)	**0.005**
Preoperative Max. Coronal Cobb (°)	18.9±16.9	18.7±17.0	19.1±17.0	0.903
Postoperative Max. Coronal Cobb (°)	11.3±12.2	11.8±13.4	10.7±10.6	0.578
Correction of Max. Coronal Cobb (°)	-7.5±11.3	-6.9±10.3	-8.4±12.5	0.433
Preoperative GCA (cm)	2.2±1.7	2.1±1.7	2.2±1.6	0.806
Postoperative GCA (cm)	1.5±1.3	1.6±1.4	1.3±1.1	0.101
Correction of GCA (cm)	-0.7±2.0	-0.5±1.9	-0.9±2.0	0.208
Preoperative TK (°)	23.2±15.1	24.4±15.8	21.6±14.2	0.273
Postoperative TK (°)	33.9±13.9	33.4±13.3	34.7±14.8	0.596
Correction of TK (°)	10.8±13.8	9.0±13.7	13.1±13.8	0.081
Preoperative LL (°)	28.5±17.0	27.4±18.3	29.8±15.2	0.405
Postoperative LL (°)	57.1±12.7	57.2±12.3	57.1±13.2	0.963
Correction of LL (°)	28.7±15.5	29.8±17.0	27.2±13.4	0.340
Preoperative PT (°)	30.6±10.3	30.8±9.1	30.3±11.7	0.797
Postoperative PT (°)	21.0±8.8	20.9±7.7	21.0±10.1	0.936
Correction of PT(°)	-9.6±9.8	-9.9±9.1	-9.3±10.8	0.732
Preoperative PI (°)	61.5±13.0	60.7±12.9	62.6±13.2	0.386
Postoperative PI (°)	60.0±12.3	60.0±12.2	59.9±12.4	0.975
Preoperative PI-LL (°)	33.2±16.2	33.3±16.6	33.1±15.8	0.942
Postoperative PI-LL (°)	10.9±8.2	10.7±7.7	11.2±8.7	0.710
Correction of PI-LL(°)	-22.2±16.5	-22.6±16.7	-21.8±16.5	0.799
Preoperative SVA (cm)	11.0±5.6	11.6±5.8	10.4±5.4	0.207
Postoperative SVA (cm)	3.9±3.2	3.7±3.2	4.1±3.2	0.399
Correction of SVA (cm)	-7.2±6.1	-7.9±6.3	-6.3±5.8	0.110
PSO angle (°)	31.9±12.4	32.4±11.9	31.3±13.2	0.616

Significant P values (P<0.05) are shown in bold print.

RF, rod fracture; BMI, body mass index; BMP-2, bone morphogenetic protein-2; GCA, global coronal alignment (distance between the central sacral vertical line and the C7 plumb line); TK, thoracic kyphosis; LL, lumbar lordosis; PT, pelvic tilt; PI, pelvic incidence; SVA, sagittal vertical axis; PSO angle, pedicle subtraction osteotomy angle.

Supplementary Table 2 Rod Fracture Characteristics and Reoperation Details by Groups in Patients without BMP-2 at Latest Follow-up

	Total (n=84)	1. Standard (n=34)	2. Satellite (n=19)	3. Nested (n=31)	P	P 1 vs 2	P 1 vs 3	P 2 vs 3
Average RF Time (Months)	34.5±23.9	32.4±25.1	42.9±20.2	33.8±24.3	0.602	/	/	/
No. of RF	42 (50.0%)	23 (67.6%)	7 (36.8%)	12 (38.7%)	**0.028**	**0.044**	**0.030**	0.895
No. of Pseudarthrosis	36 (42.9%)	18 (52.9%)	7 (36.8%)	11 (35.5%)	0.304	/	/	/
No. of Reoperation	37 (44.0%)	16 (47.1%)	11 (57.9%)	10 (32.3%)	0.187	/	/	/
No. of Reoperation for RF	25 (29.8%)	13 (38.2%)	4 (21.1%)	8 (25.8.5%)	0.352	/	/	1.000
RF Location								
At the osteotomy site	32 (76.2%)	19 (82.6%)	4 (57.1%)	9 (75.0%)	0.381	/	/	/
Above or below the osteotomy site	10 (23.8%)	4 (17.4%)	3 (42.9%)	3 (25.0%)				
Partial or Complete Implant Failure								
Partial Implant Failure	31 (73.8%)	12 (52.2%)	7 (100.0%)	12 (100.0%)	**0.002**	**0.029**	**0.005**	/
Complete Implant Failure	11 (26.2%)	11 (47.8%)	0 (0.0%)	0 (0.0%)				
RF with or without Symptom								
Symptomatic RF	28 (66.7%)	14 (60.9%)	6 (85.7%)	8 (66.7%)	0.475	/	/	/
Asymptomatic RF	14 (33.3%)	9 (39.1%)	1 (14.3%)	4 (33.3%)				

Significant P values (P<0.05) are shown in bold print.

RF, rod fracture.