

Improved Sagittal Alignment is Associated with Early Postoperative Neck Disability and Pain Related Patient Reported Outcomes following Posterior Cervical Decompression and Fusion for Myelopathy

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INTRODUCTION: The purpose of this study was to compare patient reported outcomes measures (PROMs) following posterior cervical decompression and fusion (PCDF) based upon changes in perioperative cervical sagittal alignment (CSA)

METHODS: We reviewed patients who underwent PCDF from C2-T2 between the years 2015 to 2020. C2 sagittal vertical axis (SVA) and C2-7 Lordosis, were assessed preoperatively and 1 year postoperatively. NDI and VAS Neck scores were collected preoperatively, 3 months postoperatively, and 1 year postoperatively. PROMs were compared based upon perioperative radiographic parameters.

RESULTS: Eighty-five patients were included in this study. Patients with preoperative C2 SVA <40mm had a larger improvement in VAS Neck pain scores at 3 months postoperative (-4.9 vs -3.0, p=0.03) and a larger decrease in NDI scores at 1 year postoperative (7.2 vs 3.1, p=0.04) than patients with C2 SVA ≥ 40mm. Patients with postoperative C2 SVA <40mm demonstrated lower VAS Neck pain scores at 3 months postoperative (2.0 vs 3.4, p=0.049) (Table 4). The cohort of patients with a decrease of C2 SVA by ≥5mm demonstrated lower NDI at 3 months postoperative but not at 1 year postoperative in comparison to patients whose C2 SVA increased or remained unchanged (11.7 vs 23.8 vs 18.2; p<0.001) (Table 5). Patients in whom both C2 SVA and C2-7 Lordosis improved demonstrated superior NDI (p<0.001) and VAS Neck (p=0.007) at 3 months but not at 1 year postoperatively (Figure 1).

DISCUSSION AND CONCLUSION: In a uniform cohort of patients undergoing PCDF from C2-T2, improvements in C2 SVA and C2-7 Lordosis were associated with improved early postoperative PROMs.



	C2 SVA <40 (n=43)	C2 SVA ≥40 (n=42)	P value	Nadir (n=4)	Lordosis (n=42)	Straight (n=27)	P value
Demographics							
Age (years)	62.2 (8.1)	60.0 (8.6)	0.168	62.7 (4.1)	63.6 (9.0)	64.8 (8.5)	0.79
Sex (n(%))			0.62				0.43
<25	13 (30.4%)	7 (13.5%)		2 (13.3%)	10 (19.2%)	8 (29.6%)	
25-35	17 (39.5%)	15 (35.7%)		1 (6.7%)	6 (11.5%)	6 (22.2%)	
>35	13 (30.1%)	21 (49.8%)		1 (6.7%)	26 (50.3%)	13 (48.2%)	
Site			<0.001				0.61
Male	21 (23.2%)	38 (73.1%)		4 (86.7%)	30 (57.7%)	13 (48.1%)	
Female	24 (27.7%)	14 (26.9%)		2 (13.3%)	22 (42.3%)	14 (51.9%)	
Diabetes	4 (23.2%)	4 (7.7%)	0.55	2 (13.3%)	6 (11.5%)	5 (18.5%)	0.32
Diabetes Mellitus	4 (23.2%)	20 (38.5%)	0.04	2 (13.3%)	16 (30.8%)	6 (22.2%)	0.79
Chronic Steroid Use	1 (2.3%)	5 (9.5%)	0.30	1 (6.7%)	3 (5.8%)	2 (7.4%)	0.52
Chronic Steroid Use	2 (8.7%)	2 (3.8%)	0.38	0 (0.0%)	5 (9.6%)	4 (14.8%)	0.53
Inflammatory Arthritis	6 (13.9%)	7 (13.5%)	0.40	0 (0.0%)	5 (9.6%)	7 (25.9%)	0.12
AS / DSRA	2 (4.7%)	2 (3.8%)	0.64	0 (0.0%)	3 (5.8%)	1 (3.7%)	0.78
Chronic Kidney Disease	0 (0.0%)	1 (1.9%)	0.16	0 (0.0%)	1 (1.9%)	2 (7.4%)	0.41
Patient Reported Outcome Measures							
NDI							
Preoperative	20.4 (7.7)	21.3 (8.4)	0.84	21.6 (8.9)	21.2 (8.0)	20.1 (8.7)	0.86
3 months postoperative	17.0 (8.0)	18.4 (8.0)	0.10	20.0 (11.1)	19.2 (8.4)	18.1 (10.0)	0.87
Δ from preoperative to 3mo postop	-2.9 (3.1)	-3.3 (4.6)	0.79	-0.4 (2.3)	-2.0 (2.2)	-1.9 (2.2)	0.87
MCID at 3 months postoperative	33.3%	16.7%	0.19	0.0%	24.1%	30.0%	0.13
1 year postoperative	14.8 (6.6)	16.5 (8.0)	0.39	14.9 (11.1)	14.7 (7.4)	14.1 (8.1)	0.46
Δ from preoperative to 1 year postop	-5.4 (7.5)	-4.8 (9.2)	0.31	-7.4 (7.5)	-4.4 (7.5)	-5.9 (10.4)	0.78
MCID at 1 year postoperative	50.0%	41.5%	0.48	0.0%	40.5%	50.0%	0.60
VAS Neck							
Preoperative	6.2 (3.0)	6.8 (3.7)	0.37	7.9 (3.1)	6.9 (3.6)	5.5 (3.1)	0.049
3 months postoperative	2.0 (2.2)	3.4 (3.0)	0.049	6.5 (2.6)	2.7 (2.3)	1.5 (1.5)	0.02
Δ from preoperative to 3mo postop	-4.2 (2.8)	-3.4 (3.2)	0.12	-1.4 (1.0)	-4.2 (3.0)	-3.0 (3.4)	0.13
MCID at 3 months postoperative	70.0%	71.9%	0.56	0.0%	64.6%	66.6%	0.002
6 months postoperative	1.6 (2.0)	2.8 (2.8)	0.07	4.3 (3.3)	2.3 (2.1)	2.1 (2.3)	0.16
Δ from preoperative to 1 year postop	-4.6 (3.1)	-4.0 (3.5)	0.39	-3.7 (4.1)	-4.6 (3.2)	-3.4 (3.3)	0.16
MCID at 1 year postoperative	70.0%	70.7%	0.40	0.0%	61.9%	68.7%	0.16

Abbreviations: Body Mass Index (BMI), Sagittal Vertical Axis (SVA), Anteroposterior Spinal Axis (ASA), Diffuse Idiopathic Skeletal Hyperostosis (DISH), Neck Disability Index (NDI), Visual Analog Scale (VAS), Minimal Clinically Important Difference (MCID)

	Decrease (n=23)	Increase (n=17)	Unchanged (n=25)	P value
Demographics				
Age (years)	68.8 (7.5)	61.8 (8.8)	62.6 (8.6)	0.006
BMI (kg/m ²)	4 (17.4%)	9 (24.3%)	7 (28.0%)	0.72
<25	4 (17.4%)	9 (24.3%)	7 (28.0%)	
25-35	5 (21.7%)	6 (16.2%)	2 (8.0%)	
>35	14 (60.9%)	22 (59.5%)	16 (64.0%)	
Sex				0.30
Male	11 (47.8%)	24 (64.9%)	12 (48.0%)	
Female	12 (52.2%)	13 (35.1%)	13 (52.0%)	
Smoker	2 (8.7%)	4 (10.8%)	7 (28.0%)	0.09
Diabetes Mellitus	9 (39.1%)	13 (35.1%)	2 (8.0%)	0.65
Chronic Kidney Disease	2 (8.7%)	2 (5.4%)	2 (8.0%)	0.87
Chronic Steroid Use	3 (13.0%)	5 (13.5%)	1 (4.0%)	0.44
Inflammatory Arthritis	3 (13.0%)	5 (13.5%)	4 (16.0%)	0.78
AS / DSRA	0 (0.0%)	2 (5.4%)	2 (8.0%)	0.41
Neurodegenerative Disease	2 (8.7%)	2 (5.4%)	0 (0.0%)	0.33
Patient Reported Outcome Measures				
NDI				
Preoperative	19.2 (6.7)	21.4 (8.8)	21.8 (8.2)	0.53
3 months postoperative	11.7 (9.0)	23.8 (7.9)	18.2 (8.2)	0.009
Δ from preoperative to 3 months postoperative	-7.5 (8.3)	-2.4 (9.4)	-3.6 (8.4)	0.13
MCID at 3 months postoperative	50.0%	4.8%	35.7%	0.001
1 year postoperative	13.1 (7.5)	16.3 (8.3)	17.2 (8.2)	0.25
Δ from preoperative to 1 year postoperative	-6.1 (6.2)	-5.1 (10.0)	-4.6 (8.2)	0.79
MCID at 1 year postoperative	56.2%	50.0%	30.4%	0.21
VAS Neck				
Preoperative	5.2 (2.5)	6.6 (2.8)	7.8 (2.4)	0.007
3 months postoperative	1.7 (1.1)	3.7 (2.8)	2.6 (2.6)	0.06
Δ from preoperative to 3 months postoperative	-3.5 (2.1)	-2.9 (3.4)	-5.2 (2.7)	0.01
MCID at 3 months postoperative	100.0%	62.5%	68.2%	0.01
1 year postoperative	1.5 (1.3)	2.4 (3.1)	2.1 (2.8)	0.57
Δ from preoperative to 1 year postoperative	-3.7 (2.2)	-4.2 (3.8)	-5.7 (3.3)	0.24
MCID at 1 year postoperative	76.5%	71.9%	76.2%	0.51

Abbreviations: Body Mass Index (BMI), Sagittal Vertical Axis (SVA), Anteroposterior Spinal Axis (ASA), Diffuse Idiopathic Skeletal Hyperostosis (DISH), Neck Disability Index (NDI), Visual Analog Scale (VAS), Minimal Clinically Important Difference (MCID)