Spine Shape vs Alignment: Which Determines the Best Outcomes in Adult Spinal Deformity?

Nicholas Scott Vollano¹, Themistocles Stavros Protopsaltis², Renaud Lafage³, Jeffrey Gum⁴, Munish C Gupta⁵, Lawrence G Lenke⁶, D. Kojo Hamilton⁷, Justin S Smith⁸, Robert Kenneth Eastlack, Gregory Michael Mundis, Han Jo Kim, Richard A Hostin, Khaled M Kebaish⁹, Bassel Diebo, Alan H Daniels¹⁰, Eric O Klineberg¹¹, Douglas C Burton¹², Christopher Ames, Christopher I Shaffrey¹³, Robert Shay Bess, Virginie Lafage³, International Spine Study Group ¹NYU Langone Health, ²NYU Hospital For Joint Disorders, ³Lenox Hill Hospital, ⁴Norton Leatherman Spine Center, ⁵Dept.

of Orthopedics, ⁶Columbia University/Allen Hospital, ⁷University of Pittsburgh School of Medicine, ⁸University of Virginia, ⁹Johns Hopkins University, ¹⁰University Orthopedics, Inc., ¹¹Uthealth Houston, ¹²Univ of Kansas Med Ctr., ¹³Duke University

INTRODUCTION:

Alignment and spine shape have been evaluated separately regarding adult spinal deformity (ASD) surgery outcomes. Overcorrected patients were shown to experience more proximal junctional kyphosis (PJK) than those functionally aligned or undercorrected. In a separate study, PJK patients were noted to have a more posteriorly translated spine shape than non-PJK patients. However, no study has investigated the impact of both alignment and spine shape on outcomes in ASD surgery.

METHODS:

Patients with posterior spinal fusion constructs spanning from the pelvis to T10 and higher were included. Linear regression was performed to predict T10PA (T10 Pelvic Angle) using age-normative short form-36 item physical component summary (PCS) and pelvic incidence (PI) for each patient. Functional alignment was defined as postoperative alignment within a 10° window around the predicted T10PA. Normative spine shape was derived from a database of asymptomatic subjects using two linear regression equations to describe the lumbar and thoracolumbar shapes. One associated L4PA with PI and L1PA, the other associated T10PA with PI and L1PA. Normative spine shape was defined as postoperative alignment within a 6-degree window of predicted thoracolumbar shape and within a 5-degree window of predicted lumbar shape. Patients were grouped based on alignment and spine shape. The frequency of severe PJK, proximal junctional failure (PJF), and health related guality-of-life (HRQOL) guestionnaire outcomes were compared between groups. Propensity score matching was employed to control for differences in baseline radiographic findings between groups.

RESULTS:

751 patients were included (Age: 63.7 ± 9.4; BMI: 28.4 ± 5.9; 79.2% female). Mean HRQL outcomes improved significantly for all groups with surgery (p<0.05). However, no differences were found between groups in HRQL improvements. The malaligned/poor spine shape group had the highest frequency of severe PJK and PJF by 2 years (27.6% and 18.1%, respectively), whereas the functional alignment/normative spine shape group had the lowest (13.3% and 7.7%, respectively), all p<0.05. his finding was redemonstrated in the propensity score matching subanalysis with severe PJK by 1 year occurring at the highest frequency in malaligned/poor spine shape patients (p=0.015). Multinomial regression revealed a higher odds of severe PJK (2.48, Cl: 1.37-4.50; p=0.003) and PJF (2.65, Cl: 1.29-5.47; p=0.008) by 2 years in the malaligned/poor spine shape group compared to the functional alignment/normative shape group. No differences in frequency of revision for PJK were observed.

DISCUSSION AND CONCLUSION: Normative spine shape with functional alignment is associated with a lower frequency and odds of severe PJK/PJF by 2 years, emphasizing the importance of assessing both shape and alignment in adult spinal deforn

-	Competion of specifies being	with the scheme is it	www.his.wee.ful	A religion of the second	NUMBER OF STREET	nana.	100.10
		Norger S	Norge A	Second growth	Annungture		
	10010-00	1/10	1.00	1.00	1.000	1000	
	1008 10080	0.0171	0.00.0	11110	1005.00	1.85	
	and a second	2552	2222	2222	1910	202	in both
	DOCTOR OF COMPANY	11.64	1.079	81.54	10.00	1.070	(and a large her)
	100.000000	12.17	100.0	18.8.7	88.57	1.700	Deskikan.
	disting its read		10.00 M	1.00.00		1.00	part -
	and last	64.64	10000	1000.00	8.6 4.00	141	1990 A.A.
	A PROPERTY AND		10.00	100		100	and the second second
	in the second	0.004	100.001	and a set			line .
- 11			10.000		81.1.00	10.000 C	1000 000
	CORNER OF CONTRACT	84184	847384	10.04	1000		and the second se
11	P.0	11100	10.7 10.0	101100	17.00	1.00	
- 1				interimental second	10.00		passes and

_	34401-721	Latin	1 person processment on	100
1.5	10	21.2+8.3	19.2 + 29.2	-00
1 658	665	62181	9.1103	
11.	alan .	dikenic)	26.6 + 10.9	- 144
111	10	30.5+0.6	404+33.1	-44
1 815	103	03182	124+314	-44
1 8 8 8	201	058+364	264+262	-44
5+1.	10	26.7 (1.8	1714387	-40
1884	865	631143	Sedem2	-44
5.5.5	101	\$121113	1041253	-10
1 + 5 1	PIS .	644466	1044115	.44
1111	10.1	20.001.0.1	1001.010	-100
22.43	101	40.0473.3	MANTIN	10

Autom
Autom
Autom
Autom
Autom

CH1
<td
HAM
HAM</th

NAME OF A	Anney Spent &		
		10.00	1.000
		1007100	
37.87	817 1.10	10.00	1.01
10140	1 807.000	1 10100	1 100
			10.0
			- 10
	100000	44100	
34107	85.02	36-69	1.65
		-	
-	Junion Relationspec		
100 AUG	Junion Robiniorem		
and and a second	Junion Kalendorgen		
and and a second	An in Kalainan		
and and	Aurion Robiniorym		
and and a second	An in Kalurum		
and display to	An 'n Kalu'nyn		
dala da constante da	Anin Kaluran		
dalah da	Ani in Kaluinan		
uhite.co.o	An in Landour		
initian of the second	And in Relation		
angaro ang	An in Kalalan		
antaro 112	An in Kalalanan		



corrections.