Focal and Dynamic Cervical Alignment Pathology Correlates with Myelopathy Severity in Cervical Deformity Patients

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Learning Objectives:

After reading this poster, participants should be able to: 1) understand that focal and dynamic parameters, may be a better indictor of quality of life than regional cervical alignment, 2) understand that NDI does not correlate with any cervical parameters, and 3) recognize that the NDI may need to be reevaluated for it's use in treatment of cervical deformity.

Introduction:

While there are numerous studies on cervical sagittal alignment, few studies actually report HRQOL correlations. This study investigates correlations between established cervical outcomes and regional, focal and dynamic alignments.

Methods:

In a retrospective review of prospectively collected cervical deformity (CD) patients, bi-variable correlations between HRQL scores and radiographic parameters were calculated using both the entire cohort and the driver of deformity (C=cervical, CT=cervico-thoracic).

Radiographic parameters included:

- Cervical Regional parameters: C2-C7 angle, cSVA, TS-CL, C0-C2 angle
- Focal parameters: number of kyphotic levels>5° (nK), maximum segmental kyphosis (maxK), number of listhesis>4mm (nL), maximum lysthesis (maxL) (*Figure 1*)
- Dynamic parameters: C2-7 range of motion (ROM), kinematic area (kArea), C0-C2 ROM (*Figure 1*)

Results:

62 patients were included (mean 61±7yo, 60%F, 32C and 29CT). Mean sagittal parameters for the cervical alignment were C2-C7 -5±30°, cSVA 47±34mm, TS-CL 35.9±26.7°, C0-C2 40±11.6°, nK 1.9±1, maxK -13.4±8.5°, nL 0.8 ±1.2, maxL 6±8mm (*Table 1*). Mean HRQOL scores included NDI 48±18, mJOA 13.5±2.4, EQ5D 9.9±2.2 and VAS 61±24.

Figure 1: Dynamic and Focal parameters
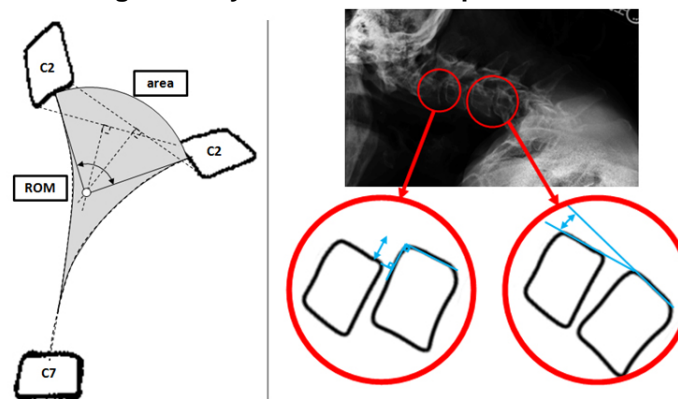
C2-7 range of motion (ROM) and kinematic area (kArea); Focal kyphosis (nK) and listhesis (nL)

Results:

There was no correlation between regional parameters and HRQOL, but **mJOA correlated** significantly with **maxK** (0.324, p=0.017) and **kArea** (0.321, p=0.023).

The stratification by deformity driver revealed significant correlations between **maxK and mJOA in the C patients**, and between **nK and mJOA in CT patients**.

In addition, radiographic parameters correlated with individual mJOA, EQ5D and NDI questions (*Table 2*).

Table1: Description sagittal parameters

	Parameter	Mean	StD
Regional parameters	C2-C7	-4.8°	30.1°
	cSVA	46.8mm	33.7mm
	TS-CL	35.9°	26.7°
	C0-C2	40°	11.6°
Focal parameters	nK	1.9	1.4
	maxK	-13.4°	8.5°
	nL	0.8	1.2
	maxL	5.6mm	7.9mm

Mean and standard deviation for ragional and focal radiographic parameters

Table 2: Correlations between radiographic parameters and HRQOL

		Regional			Focal				Dynamic		
	HRQOL	cSVA	TS-CL	C0-C2	nK	maxK	nL	maxL	ROM	kArea	C0-C2 ROM
Full cohort	mJOA					0.324				0.321	
	mJOA - Upper	0.334									
	mJOA - Lower								0.335	0.267	
	EQ5D - Selfcare										0.368
Cervical	mJOA					0.409					
	mJOA - Sensaion		0.429	0.398			-0.392	-0.366			
	mJOA - Lower					0.427					
Cervico-Thoracic	mJOA				0.443						
	mJOA - Upper								0.402	0.471	
	NDI - Pain	0.424									

All correlation are significant p<0.05; Upper/Lower = Motor Score

Conclusions:

In cervical deformity patients, **focal and dynamic parameters** correlated more with **mJOA** than did regional cervical alignment. This suggests that **focal and dynamic parameters play a larger role in the quality of life** of these patients than regional cervical alignment. The NDI total score did not correlate with any cervical parameters.These findings call into question the utility of the NDI when evaluating patients with cervical deformity. Futher studies should investigate a **specific quality of life questionnaire for cervical deformity patients**.

References:

1. Liu S, Lafage R, Smith JS, et al. **The Impact of Dynamic Alignment, Motion, and Center of Rotation on Myelopathy Grade and Regional Disability in Cervical Spondylotic Myelopathy**. In: International Meeting on Advanced Spine Techniques (IMAST); July 16-19. Valencia, Spain; 2014.
2. Tang J a., Scheer JK, Smith JS, et al. **The impact of standing regional cervical sagittal alignment on outcomes in posterior cervical fusion surgery**. Neurosurgery. 2012;71(3):662-669. doi:10.1227/NEU.0b013e31826100c9.