

The Crucial Role of Cervical Alignment in Regulating Sagittal Spino-Pelvic Alignment in Human Standing Posture

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Introduction: Individuals maintain specific alignment relationships from the skull to the pelvis to maintain painless upright posture. Purpose: evaluate alignment correlations from the cervical spine to the pelvis to determine regional postural adaptations needed to maintain optimal sagittal position and level horizontal gaze.

Methods: Asymptomatic volunteers enrolled in a single-center prospective study evaluating normative sagittal alignment. Inclusion criteria: 18 < age < 80 years. Exclusion criteria: history of low back pain, back surgery, hip or knee disorders and arthroplasty. Full-length standing radiographs were analyzed (Fig. 1). Stratification by age (20-39, 40-59, =60 years). Lordosis was denoted positive, kyphosis denoted negative.

Table 1: Sagittal parameters results

	All patients	20-39 years (22)	40-59 years (19)	>60 years (14)	p-value
	Mean	Mean	Mean	Mean	
CL	+11.7	+9.4	+6.6	+22.2*	<0.001
TK	-39.5	-38.1	-36	-45	NS
LL	+59.6	+61.5	+60.3	+55.7	NS
PT	+14.2	12.1	14.5	15.1	NS
PI	+53.3	52.1	54.3	53.5	NS
SS	+39.1	40	39.9	36.5	NS
T1-Slope	-24.2	-22	-21.1	-31.6*	<0.001
SVA	-12.0	-28.5	-18.2	22.4*	<0.001
SVA_C2	2.7	-12.8	-1.7	35.2*	<0.001
SVA_C2-SVA	19.8	15.7	22.5	22.9	NS
C2_slope	14.0	14.3	16.8	9	NS

Older patients had greater SVA, SVA_C2, T1 slope, and cervical lordosis. PI-LL correlated with PT, TK and SVA, but not with SVA_C2 and SS. CL correlated with PT, TK and SVA. SVA and CL of patients increase with age, 'forcing' the patient to correct their level gaze (Fig. 3), without succeeding in correcting the global alignment at the C2 level.

Fig. 3: CL Mechanism of adaptation

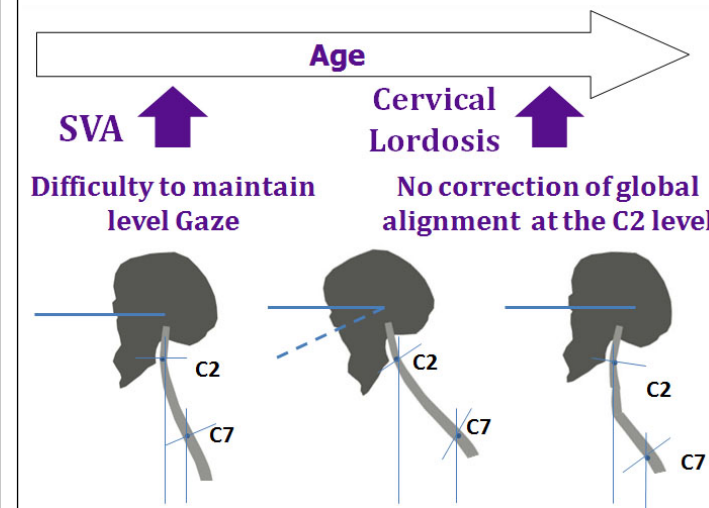


Fig. 4: Correlation with HRQOL scores?

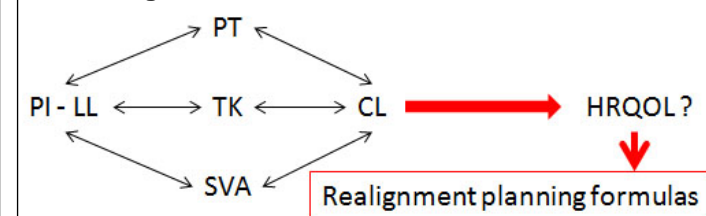


Fig. 1: Radiographic parameters

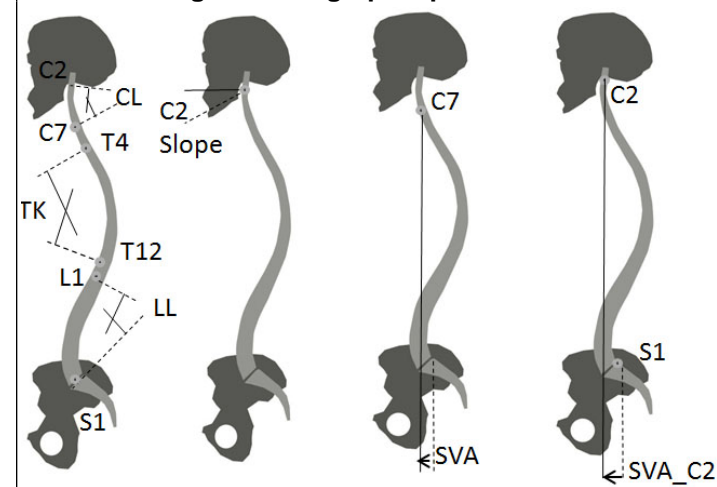
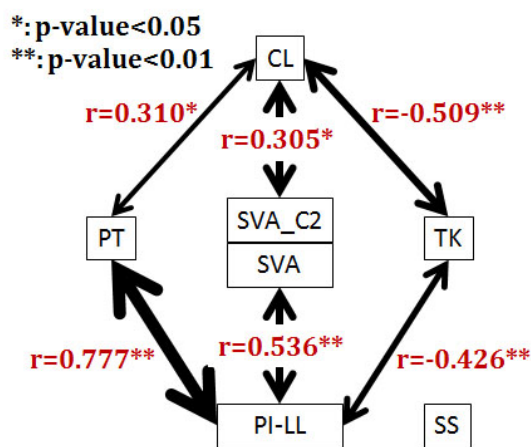


Fig. 2: Chain of correlation with PI-LL



Results: 55 adult volunteers (27 men), 45 years from 20 to 77 were analysed. Average regional sagittal parameters and global alignment parameters are in table 1.

Conclusions: LL is a key element for the global sagittal alignment (adaptability to PI, PT and TK). and to reduce the SVA. Adaptability of the CL to TK, PT, and SVA. Objective of the CL is to maintain the level gaze, but doesn't play a role in the compensatory mechanism. A limitation of this study is correlation with HRQOL scores. CL correlates significantly with PT, and TK. A large CL allows a harmonious distribution and compensatory loss of LL by increasing TK.