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On Behalf of the French Spine Surgery Society (SFCR)

Introduction

When planning surgery for correction of adult spinal deformities, considering lumbar lordosis (LL) as a uniform segment is an approximation that can lead to planning errors. We hypothesized that pelvic incidence (PI) and age influence the level of the thoracolumbar inflection point and the distribution of segmental lordosis. The purpose of this study was to determine the distribution and correlations between the thoracolumbar junction segment, proximal and distal LL according to PI and age.

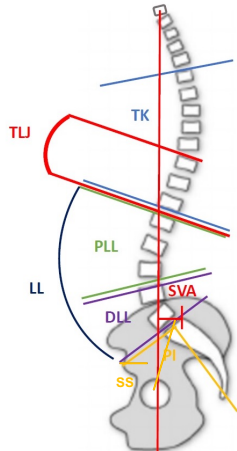


Figure 1. Segmental alignment parameters: thoracic kyphosis (TK), thoracolumbar junction (TLJ), proximal (PLL) and distal (DLL) lumbar lordosis (LL).

Materials and Methods

This is a retrospective study of a multicenter prospective database. Radiographs of 1540 subjects were analyzed and divided into 3 PI groups: low $<45^\circ$, intermediate $45-60^\circ$, high $>60^\circ$ and stratified by age (<45 years, $45-70$, and >70). The different segments of L1-L4 proximal lumbar lordosis (PLL), L4-S1 distal lumbar lordosis (DLL), and T10-L1 thoracolumbar junction (TLJ) were analyzed.

Results

The mean age was 53.5 years (SD=17, min=20, max=93). There was a significant correlation between thoracic kyphosis T5-T12 and TLJ segment T10-L1 ($R = 0.581$, $p < 0.001$). Only the L1-L4 PLL segment correlated with PI ($R = 0.47$, $p < 0.001$). The T10-L1 TLJ segment was constant regardless of age or PI groups considered (mean = -8° , SD=9). PLL did not vary with aging but differed according to PI. The DLL showed significant differences between age and PI groups but without significant correlation between PI and DLL.

Conclusion

Pelvic morphology is known to determine the curvatures of the spine, with high PI leading to high lordosis and low PI leading to low lordosis. However, the distribution of lumbar lordosis is not homogeneous. Our study provided a normative value reference and showed that T10-L1 is constant regardless of the age or pelvic incidence. In a large population, age-related physiological degenerative phenomena are characterized by an increase in TK and a small decrease in DLL while PLL and T10-L1 thoracolumbar junction segment remained stable during aging.

References

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	PI Groups				Age groups			
	PI $<45^\circ$ (N=378)	PI $45-60^\circ$ (N=762)	PI $>60^\circ$ (N=400)	P-value	<45 ys (N=511)	45-70 ys (N=699)	>70 ys (N=330)	P-value
Age	49 ys	55 ys	56 ys	<0.001	34 ys	57 ys	77 ys	<0.001
PI	39°	53°	68°	<0.001	52°	53°	55°	<0.001
SS	39°	36°	45°	<0.001	38°	36°	34°	<0.001
PT	10°	16°	23°	<0.001	13°	17°	21°	<0.001
T5-T12 TK	-34°	-37°	-37°	0.001	-34°	-36°	-40°	<0.001
T10-L1 TLJ	-8°	-8°	-7°	0.437	-7°	-7°	-8°	0.291
LL	47°	55°	65°	<0.001	58°	55°	52°	<0.001
L1-L4 PLL	12°	17°	25°	<0.001	19°	18°	17°	<0.001
L4-S1 DLL	34°	36°	39°	<0.001	38°	36°	34°	0.041
SVA	11 mm	23 mm	34 mm	<0.001	6 mm	23 mm	50 mm	<0.001

Table 1. Stratification of radiographic parameters according to pelvic incidence (PI) and age