O12.73 Sagittal and coronal spine balance in 584 healthy subjects: clinical plumbline values and correlation with x-ray measures

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Introduction: X-ray is the gold standard to evaluate spinal sagittal and coronal parameters. To reduce the burden of x-rays and reduce costs, easy to use tools are used in clinical practice. Plumbline Distances (PD) showed acceptable repeatability, good validity and sensibility in identifying thoracic hyperkyphosis, however no study provided normative data of healthy subjects at different age and bone maturity.

Objectives: To assess the normative clinical value of the plumbline distances in a healthy wide population of growing subjects and to correlate it with x-ray measures.

Methods: Design: cross-sectional study. Participants: 584 healthy subjects (341 females) presenting for a first visit with x-rays showing no spine deformity. The whole sample (ALL) was divided in 5 groups according to age and bone maturity: 6-9 years old (n=106); >10 ys, open triradiate cartilage, Risser 0 (n=129); > 10 ys, closed triradiate cartilage, Risser 0 (n=104); Risser 1-2 (n=126); Risser 3-5 (n=119).

The plumbline distances were taken by maintaining a tangent to thoracic kyphosis apex, at the following points: C7, T12, L3, S2. Kyphosis Index (KI) (C7+L3), sagittal and coronal balances (C7-S2) were calculated.

Statistics: descriptive statistics to summarize the sample characteristics, one way ANOVA to test differences in the age groups, Pearson correlation to correlate clinical with x-ray measures.

The study was approved by the local Ethical Committee and informed consent from participants was collected before recruitment.

Results: In ALL plumbline distances at C7, T12, L3 and S2 were respectively 39.9±16.7 (CI 95% 38.6-41.3), 21.4±15.3 (CI 95% 20.2-22.7), 39.9±15 (CI 95% 38.6-41.1), 20.6±17 mm (CI 95% 19.3-22); KI was 79.8±26.8 mm (CI 95% 77.6-82), sagittal balance was 19±16.9 mm (CI 95% 18-20.7), it was positive (C7 anterior to S2) in 84% of subjects; 13.5% had a coronal imbalance of 11.4±5.4 mm (CI 95% 10.2-12.6) to the right and 24.7% had a 13.2±6 mm (CI 95% 10.2-12.6) to the left. ANOVA of KI and sagittal balance showed a significant difference ($p<0.0001$) between groups, with a progressive increase from 6-9 years old Group to Risser 1-2 Group. KI correlated to thoracic kyphosis Cobb degrees (r=0.46).

Conclusions and significance: The present study presents the normative value of a very easy and feasible clinical tool: the plumbline distances. These values can be considered as a reference during patient evaluation. The radiographic exam remains a standard to make diagnosis. Further studies will compare these normative with pathological data.