Paper #7: Spinal Growth In Normal Children Between 3 And 11 Years Old Using 3D Reconstruction: A Longitudinal Study.

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**Introduction:** New imaging systems and techniques in the last two decades have led to the development of new 3D reconstruction techniques of the spine. This study documents the normal spinal evolution for kyphosis, lordosis, total height, vertebral dimension and vertebral growth following 3D reconstructions of the spine in normal children under the age of 11 years. To this date, there is no data on spinal growth in children under 11. This study is the first of a series to give information on the subject.

**Methods:** EOS Imaging x-rays of all patients seen between 2007 and 2014 at the spinal clinic of a major metropolitan referral center were reviewed and all asymptomatic patients with a curve of less than 10° and that had more than one visit were identified. The Postero-anterior and Lateral calibrated radiographies were used for 3D reconstruction of the spine. Means and standard deviations for kyphosis, lordosis, total height, vertebral dimension and vertebral growth were calculated.

**Results:** A total of 98 asymptomatic patients with at least one follow-up were identified as having no spinal deformities on the radiographs and a total of 259 spines were reconstructed. Mean kyphosis was 31.3° ± 8.5° (range 10.6-50.7) and mean lordosis was 51.3° ±11.4° (range 24.7-84.6). Mean total height for 3 to 6 years old (yo) was 280.5mm ±14.8mm (range 257.0-312.9), the mean for the 6 to 8 yo was 307.9mm ±15.0mm (range 279.6-330.3) and the mean for the 8 to 10 yo was 332.9mm ±26.1mm (range 281.9-398.8). Figure 1 presents the scatter diagram of the spinal length as a function of age for the 259 reconstructions.. The mean monthly growth was 1.19 mm/month±0.4 for the 3 to 6 yo patients, 1.13 mm/month ± 0.22for the 6 to 9 yo patients and 1.20 mm/month ± 0.65 for the 8 to 10 yo patients.

**Conclusion:** The current study represents the first attempt to measure spinal growth in follow-up patients under the age of 11 years, using 3D reconstruction of the spine. The results give us important knowledge on normal spinal evolution and growth of the different age categories of this population. The information obtained allows us to start a database for the elaboration of a spinal standard growth curve that could help healthcare providers better assess their patients’ spinal growth. This data could eventually be used to predict spinal length at maturity or spinal height changes in pathologic conditions.
Total Spinal Height and Chronological Age
(n=258 reconstructions)

\[ y = 12.604x + 219.29 \]

\[ R^2 = 0.5881 \]