Measuring Spinopelvic Parameters in Patients with 6 Lumbar Vertebrae: A Matched Comparison of Asymptomatic Volunteers

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ABSTRACT SECTION #1: Objectives

Spinopelvic parameters are crucial for evaluating sagittal alignment and guiding surgical planning. While traditionally measured using the superior endplate of S1 as a reference, anatomic variants such as the presence of a sixth lumbar vertebra (L6) complicate this convention. In such cases, it remains unclear whether to use L6 or S1 as a reference for measurements. This study aims to assess the difference between L6 and S1 as a reference in comparison to matched controls.

ABSTRACT SECTION #2: Method

Volunteers with no pre-existing spine or hip pathology were recruited (n = 497). Whole-body 2D EOS scans were obtained. Cases with a well-formed L6 vertebrae were identified (n = 29). Two independent surgeons reviewed radiographs included in the L6 cohort and spinopelvic angles were calculated. Measurements included lumbar lordosis (LL), pelvic incidence (PI), pelvic tilt (PT), sacral slope (SS), L1-pelvic angle (L1PA), T4-pelvic angle (T4PA), and sagittal vertical angle (SVA) using both L6 and S1 as a reference. Cases were matched 1:1 to normative controls based on PI and SS.

ABSTRACT SECTION #3: Results

Nine cases referenced from S1 and eight cases referenced from L6 were successfully matched to controls within one degree. In the S1 reference cohort, PI and SS were found to be significantly higher in comparison to the L6 reference cohort (PI 49.6° vs. 42.7°, p=.038; SS 43.0° vs. 32.5°, p <.001). L5-6 and L6-S1 lordosis were significantly higher in the S1 reference group compared to the L6 reference group. Furthermore, the total lordosis from L4-S1 in the S1 reference group (37.3°) more closely resembled established norms than did the L6 reference group (25.4°).

ABSTRACT SECTION #4: Conclusions

After matching to normative controls, the S1 reference cohort had significantly higher values in PI, SS, L5-L6 and L6-S1 lordosis compared to the L6 reference cohort. Additionally, the S1 reference group had a more physiological L4-S1 total lumbar lordosis. This suggests that if the L6-S1 disc is lordotic, using S1 as a reference likely provides more accurate spinopelvic measurements in patients with a L6 vertebrae.