Spine Phantoms are Inadequate for DXA Whole Body Composition Cross-Calibration
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When changing DXA scanners, it is critical for patient continuity of assessment that measurements be consistent between instruments; consequently, cross-calibration is necessary. To this end, when replacing a DXA unit with the same model, ISCD recommends scanning phantoms 10 times on each instrument and states spine BMD should be within 1%, while %fat, lean and fat mass should be within 2% of the prior instrument. However, data validating this approach for body composition assessment are limited. Here we report a total body cross-calibration experience comparing phantom data with that obtained from in-vivo human volunteers.

Total body composition was being measured longitudinally in a cohort of young adults using a GE Lunar-iDXA. These individuals were transitioning to a newly installed iDXA. To ensure consistent measurements, cross-calibration was performed using two encapsulated spine phantoms (GE-Lunar & BioClinica), one body composition phantom (BioClinica) and 30 human volunteers. Thirty scans of each phantom were obtained on the existing and newly installed DXA instruments without repositioning. Additionally, to enhance confidence in cross-calibration, whole-body scans were obtained in 30 volunteers, once on each instrument. Each scan pair was obtained within an hour of each other with no change in clothing; additionally, food ingestion and voiding was prohibited between scans.

Lunar and Bioclinica spine phantom BMD means were very similar, both within 1% of the existing unit, and demonstrated biases of only -0.01 g/cm². With the total body phantom, BMD and BMC were within 2% of the existing instrument with biases of 0.005 g/cm² and 3.3 g respectively. However measurements differed from 4.6 to 7.8% for lean, fat and % fat mass with biases of +463 g, -496 g and -2.8% observed for lean, fat and percent fat respectively. The in-vivo comparison verified the phantom data with BMD/BMC within ~2% but lean, fat and %fat differing by 1.6 to 4.9% with biases of +833 g, -860 g and -1.2% respectively. As both the phantom and in-vivo body composition values exceeded the 2% recommendation, the manufacturer re-calibrated the new instrument to perform within initial scanner parameters. After adjustment, based on in-vivo %fat data, bias for lean and fat improved to -22.7 g and -4.6 g respectively falling within 0.1% of the existing instrument. The phantom improved, reducing percent difference from 2.6 to 4.8%.

Recognizing that this study evaluated only two iDXAs, these data suggest the BioClinica total body phantom behaves similar to human in-vivo measurements for cross-calibration of like model instruments. Additionally, although falling within the suggested 1% parameters for BMD and BMC, the spine phantom was unable to detect the substantial differences in lean and fat mass observed with the body composition phantom and in-vivo assessments. Consequently, spine phantoms alone are inadequate to assure whole body composition cross-calibration.