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Jodie Gomez
Rachel Tufaro
Ashkan Pourkand
David Grow
Christina Salas

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Sensitivity of Bone Mineral Density Measurements to Axial Rotations and Scan Analysis in Dual Energy X-Ray Absorptiometry of the Lateral Distal Femur

Jodie Gomez, BS1,3; Rachel Tufaro, BS2,3; Ashkan Pourkand, MS4; David Grow, PhD3,4; Christina Salas, PhD1,2,3

INTRODUCTION
- Dual energy x-ray absorptiometry (DXA) is the current standard for measuring bone mineral density (BMD) as it offers quick scan times with low radiation dose
- When scanning the hip or spine of non- or minimally-ambulatory patients, surgical implants or severe contractures can limit the ability to produce accurate and repeatable measures for tracking BMD over time
- The lateral distal femur is being studied as an alternative scanning location, particularly in pediatric patients, to avoid these problems[1] (Fig. 1)

PURPOSE
- To determine the sensitivity of BMD measurements using DXA in a cadaveric study: i) due to the effect of axial rotations of the femur that occur when positioning the patient; and ii) due to the effect of selecting the region of interest (ROI) when analyzing the DXA scan

METHODS
- Eight fresh frozen cadaver legs from mid-femur to foot were used in this study
- The femoral canal was fitted with a 9-axis orientation sensor to measure axial alignment (Fig. 2A)
- The femur is positioned lateral side down on the DXA table, considered 0 degrees (neutral)

RESULTS
- A significant difference in percent change in BMD was found between the neutral position and 2, 5 and 10 degrees of internal and external rotation (p=0.04, p=0.05, p=0.01, respectively)
- No significant difference in BMD was found between the neutral position and any of the external rotations
- Mean percent change in BMD was 2.4±0.89% and 0.88±0.22% for internal and external rotation, respectively

CONCLUSIONS
- Bone mineral density measurements are affected by the apparent change in projected cross-sectional area caused by axial rotations of the femur and by the positioning of the ROI during scan analysis

CLINICAL RELEVANCE
- Variability in patient positioning and ROI selection by the DXA technician may affect the BMD measures in longitudinal studies of pediatric patients
- This may affect course of treatment defined by the physician
- This study supports the need for a bracing system that can assist with repeatability in patient positioning for longitudinal scans

REFERENCES

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