Comparison of Lunar DXA and QCT at the Femoral Neck using Asynchronous Calibration of CT Colonography Exams.

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Introduction
Opportunity exists for concurrent BMD screening without additional imaging
For patients undergoing screening CT colonography (CTC), an opportunity exists for concurrent BMD screening without additional imaging, radiation exposure or patient time. This may be achieved using Quantitative CT (QCT). Previous studies combining CTC and QCT have focused on the spine. This study investigated the use of DXA-equivalent QCT “CTXA” analysis at the hip obtained using CTC exams.

Methods
Scans were performed in 2007-2008 and measured with CT calibration performed in 2012
Our retrospective cohort included 33 female subjects that had a routine CTC using a GE Lightspeed 16 or GE Lightspeed Ultra and a DXA hip BMD exam using a GE Lunar Prodigy (GE Healthcare, Waukesha, WI) 0-9 months (mean 2.3 months) after. All scans were performed between January 2007 and November 2008, with BMD reported in T-scores. The mean (SD) age of subjects was 61.3 (10.6) years at the time of CTC, with a range of 49 to 86 years. Areal BMD in T-scores of the proximal femur was measured from either prone or supine CTC exam using QCT Pro Version 5.0 (Mindways Software, Austin, TX) following standard workflow except that the calibration of CT scanners was made by analyzing the calibration phantom scanned asynchronously in August 2012, that is, retrospectively of the CTC exam without the subject present.

Results
The standard error of the estimate was 0.379 T-scores
QCT BMD measurement and DXA BMD measurement were highly correlated (R² = 0.907) with a linear relationship of \( \text{DXA}_{\text{BMD}} = 1.297 \times \text{QCT}_{\text{BMD}} + 0.048 \). The SEE on the linear fit was 0.053 g/cm². The results for QCT T-Score measurement and DXA T-Score measurement are as shown on the right, and have a linear relationship of \( \text{DXA}_{\text{T-score}} = 1.034 \times \text{QCT}_{\text{T-score}} + 0.3 \). The SEE on the linear fit was 0.379 T-scores.

Discussion
The observed relationship is consistent with predictions derived from earlier publications
QCT and DXA aBMD and T-score measurements showed excellent correlation despite the approximate four year time gap between patient data acquisition and retrospective QCT calibration of the CT scanners used to acquire the patient data. The SEE of 0.053 g/cm² is comparable with figures in the literature comparing Hologic and Lunar DXA equipment [1]. The observed relationship between QCT and Lunar DXA BMD estimates is consistent with predictions derived from published cross-calibration relationships relating QCT BMD estimates to Hologic BMD estimates [2] and then Hologic to Lunar BMD estimates [3]. These equations capture both differences in density calibration standards (CaHAP versus K,HPQ) as well as differences in femoral neck ROI definition. The offset difference between Lunar DXA and CTXA QCT BMD results may be corrected for by using a conversion from the paper by Khoo et al [2] which gives: Hologic DXA_{BMD} = (QCT_{BMD} + 0.004) / 0.888 and the correction from Binkley et al [3] which gives Lunar DXA_{BMD} = 0.045 + 1.158 \times \text{QCT}_{\text{BMD}} so that Lunar DXA_{BMD} = \text{QCT}_{\text{BMD}} \times 1.304 + 0.05 which is close to our derived linear relationship. The correlation and consistency with established methods indicates that opportunistic use of QCT T-scores obtained at the time of CTC can enhance osteoporosis screening.

References

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