quantifiably better.

Prospective Comparison of QCT BMD Measurement using either Asynchronous or Simultaneous Calibration at the Femoral Neck and Lumbar Spine

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Introduction & Objectives

Limitations of conventional QCT can be overcome with asynchronous calibration techniques

Conventional QCT calibration requires simultaneous scanning of patient and phantom. We compared BMD estimates using conventional versus asynchronous QCT calibration, in which the calibration phantom is scanned separately from the patient. Advantages of this method include simplification of workflow, dual-use of CT studies, and retrospective analysis of images.

Methods

A prospective study was undertaken to detect potential bias in new QCT calibration technique.

IRB approval was obtained for a prospective study of measurement bias between asynchronous and simultaneous QCT BMD estimates. The study was powered to detect a 1% bias relative to mean young normal BMD. Three clinical sites recruited a total of 43 subjects (ages 44-80). Each subject received two QCT scans: one with and one without a calibration phantom present with the patient during the scan.

Results

High correlations were found at both spine and hip ROIs.

Regression analysis shows that the lumbar spine measurements are strongly correlated ($R > 0.97$) with small standard error (SEE) = 5.98 mg/cm^3. A paired t-test indicates the means are significantly different ($P < 10\text{-}6$), with a difference of means of 3.7 mg/cm^3 or 0.14 T-Scores. Linear regression at the femoral neck shows strong correlation ($R = 0.96$) with small standard error (SEE) = 0.025 g/cm^2. A paired t-test did not indicate a significant difference in mean BMD ($P = 0.47$).

Conclusion

Observations limit the bias of the new QCT calibration technique to much less than the accepted error in BMD measurement.

No bias was found in proximal femur aBMD estimates. A small bias was found in lumbar spine vBMD estimates in the presence versus absence of a CT calibration phantom. This bias is considerably less than the error usually associated with BMD measurement, typically ±0.4 T-scores for DXA, and is therefore very unlikely to be clinically significant. This workflow change could greatly enhance osteoporosis screening since BMD can be easily measured regardless of the clinical indication for CT scanning.