Abstract:
The purpose of this study was to investigate whether the combination of dual-energy X-ray absorptiometry (DXA)-based bone mass and magnetic resonance imaging (MRI)-based cortical and trabecular structural measures improves the prediction of radial bone strength. Thirty-eight left forearms were harvested from formalin-fixed human cadavers. Bone mineral content (BMC) and bone mineral density (BMD) of the distal radius were measured using DXA. Cortical and trabecular structural measures of the distal radius were computed in high-resolution 1.5T MR images. Cortical measures included average cortical thickness and cross-sectional area. Trabecular measures included morphometric and texture parameters. The forearms were biomechanically tested in a fall simulation to measure absolute radial bone strength (failure load). Relative radial bone strength was determined by dividing radial failure loads by age, body mass index, radius length, and average radius cross-sectional area, respectively. DXA derived BMC and BMD showed statistically significant (p< 0.05) correlations with absolute and relative radial bone strength (r<= 0.78). Correlation coefficients for cortical and trabecular structural measures with absolute and relative radial bone strength amounted up to r = 0.59 and r = 0.74, respectively, (p< 0.05). In combination with DXA-based bone
mass, trabecular but not, cortical structural measures, added in multiple regression models significant
(p< 0.05) information in predicting absolute and relative radial bone strength (up to R = 0.88). Thus, a
combination of DXA-based bone mass and MRI-based trabecular structural measures most
accurately predicted absolute and relative radial bone strength, whereas structural measures of the
cortex did not provide significant additional information in combination with DXA.

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