REFERENCE GRAPHS OF AGE-RELATED CHANGES IN BONE MASS, VOLUMETRIC DENSITY, DESIGN AND STRENGTH AND OF MUSCLE-BONE INTERACTIONS IN NORMAL MEN AND WOMEN


GENERAL BACKGROUND AND AIMS OF THE STUDY

The dQCT technology provides a useful set of indicators of bone "mass" (BMC, cortical area, trabecular vBMD), bone material "quality" (cortical and trabecular vQCT, or corrected for the partial volume effect, Rho->vQCT, known to vary linearly with the intrinsic stiffness or elastic modulus of the tissue), bone design (dQCT-derived cross-sectional moments of inertia, CSM) and bone strength (calculated from bending or stress-strength indices, BSI,SSI, and of muscle strength (muscle cross-sectional area, mCSA)) (Fig 1). Analysis of the behavior of these indicators offers an interesting diagnostic tool for osteopenic and osteoporotic, beyond the scope of standard DXA determinations.

Results, no reference charts are available as those indicators as determined in healthy individuals for comparative diagnosis. In order to overcome this inconvenience, we have performed dQCT scans of femurs and legs (B.S. different ages, Fig 2) on a number of normal, unrafted men (n = 60, age 18-77 yr), post-MP women (n = 60; age 18-54) and post-MP women (n = 120; age 44-60). The collected information was then analyzed aiming to describe the suitable for interrelationships of the above entered indicators.

RESULTS

Three different patterns of variation of the studied indicators were shown:
1. Bone "mass" indicators were significantly higher in males than females and decayed slightly after MP (Fig 2-5).
2. Bone material "quality" (as assessed by vQCT or Rho->vQCT) was significantly higher in pre-MP men than men and decayed dramatically after MP (Fig 6).
3. Bone design was better in men than women but did not decay after MP (Fig 7).
4. The calculated BSI and SSI (all correlate to the product CSM x vQCT) thus more influenced by the large elastic anisotropy of the CSMs than by the relatively much smaller physiological changes in vQCT varied similarly to bone mass or bone design indicators (Fig 2).

Muscle mass (somatometrically adjusted to bone size) was higher in men than women and tended non-significantly to decay after MP (Fig 9).

Bone mass, design and strength indicators (not so the vQCT) were linearly correlated with mCSA in all 3 groups, with parallel slopes for men and pre-MP women and lower slopes for post-MP women (Fig 10). The SD-scoring of the relationships between bone mass, design or strength indicators and the mCSA for man and pre-MP women allowed calculation of individual Z-scores of every relationship for any kind of individuals, including the studied post-MP women (Fig 4).

The Z-scores for the relationships between bone mass or strength (not CSM or vQCT) and mCSA correlated negatively with years since MP (15MP; Fig 10, 12, 14).

INTERPRETATION

Results show that, despite post-MP women lose significant amounts of bone mass after MP, they tend to remain stronger to maintain bone-muscle strength and strength.

From a practical point of view, our findings point out that the dQCT can be used to evaluate both the differences between the bone indicators, and of those with 15MP provided normal references suitable for evaluation of the bone-muscle relationships of "bone quality", namely, bone material quality and design, and the reference charts of the bone-muscle relationships allowed a non-invasive distinction between "diseased" and "normal" osteoporosis (with normal or reduced bone-muscle Z-scores, respectively) requiring substantially different treatments.