Conclusion: The study established that the genotype Bb is characterized with high bone mineral density, low incidence of osteoporosis and fractures.

IBDW2014-00096-F0027 CARTILAGE MICROSTRUCTURE ASSESSED BY HIGH RESOLUTION MICRO-COMPUTED TOMOGRAPHY IN NON OA KNEES

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Introduction and aims: In osteoarthritis (OA), loss of the articular cartilage, changes of the cortical subchondral plate and alterations in subchondral bone architecture are observed. At the microscopic level, no established 3D method exists to measure cartilage volume and thickness. The objective was to develop an easy-to-implement method for precise and accurate measurements of volume and thickness of cartilage from micro-CT images and to apply the new method to a larger amount of data obtained from human cadavers.

Methods: Twenty five left cadaveric knees without OA as determined from radiographs using an adapted Kellgren-Lawrence grading scale (grade=2) from 13 women and 9 men (mean age 80.9±10.0 years) were included in the study. After dissection, cortical cores (7 mm in diameter) were extracted in the lateral region of the lateral tibial plateau. The native cores were imaged with micro-CT (Skyscan 1172™), voxel size 10.2 mm2 and the following parameters were measured: cartilage volume (Cart.Vol, mm3) after manual contouring of the cartilage following interpolation with the software from Skyscan: Ctal, Cartilage thickness (Cart.Th, mm) was determined manually (man) and by using the thickness plugin of BoneJ (plug), which was originally developed to measure trabecular thickness. In a subgroup of 20 cores, short term reproducibility (RMSCV%) was determined from 3 acquisitions with intermediate repositioning. One scan per specimen was analyzed 3 times by the same observer (intra-observer: IA) or by three different observers (inter-observer: IIE). In order to assess accuracy in a subgroup of 10 cores, holes with diameters of 2 mm, 3 mm, and 4 mm were artificially generated with a dermatological punch. The accuracy error was determined by comparing nominal and measured hole sizes (Wilcoxon test and Bland and Altman plots).

Results: Mean Cart.Vol was 69.6±10.9 mm3 (man). Mean Cart.Th was 1.75±0.29 mm (man) and 1.78±0.26 mm (plug). The thickness variation was 0.13±0.06 mm and the maximum thickness was 1.94±0.26 mm (plug). The correlation between the two Cart.Th analysis techniques was r=0.94 (p<10^-4). For the measurement chain, the Cart.Vol.RMSCV was 1.35%. For the image analysis, the Cart.Vol.RMSCV were 0.42% and 1.80% for IA and IIE, respectively. Mean±SD of the nominal hole volumes were 7.2±2.0 mm3 (2mm), 16.7±4.1 mm3 (3mm), 27.9±8.6 mm3 (4mm), and the measured volumes were 7.7±2.4 mm3 (2mm), 17.1±5.7 mm3 (3mm) and 27.6±8.6 mm3 (4mm) with no significant differences. The mean biases were -0.49±1.6 mm3 (2mm), -0.41±4.2 mm3 (3mm) and -0.34±4.4 mm3 (4mm).

Conclusion: In conclusion, with micro-CT, it was possible to measure the cartilage volume and thickness in 3D in humans with good precision and accuracy.

IBDW2014-00097-F0028 CHANGES IN PROXIMAL FEMUR STRUCTURE IN CAUCASIAN FEMALES AGED 20 TO 89 YEARS: IMPLICATIONS FOR HIP FRACTURE AND JOINT REPLACEMENT

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Introduction and aims: Areal bone mineral density (aBMD), although useful for fracture prediction, obscures the true 3 dimensional changes in cancellous and cortical mass and volume by integrating mass over a planar area of interest.

Methods: Proximal femur structure was measured in 719 female Caucasians aged 20 to 89 years using QCT (Kho et al., Osteoporos Int 2009: 20: 1539). CT scanner performance and protocols were characterized using a Mindways QA phantom and QA scans and mineral mass estimates normalized by CT-scanner specific field-uniformity correction using Mindways BIT software (Mindways Software Inc., Austin, Texas USA). Three regions of interest were defined using an algorithm derived from the DAXA approach, the femoral neck (FN), trochanter (TR) and intertrochanter (IT). Voxels with a density greater than 350 mg/cm3 were classified as cortical. The mineral mass and volume were computed for the integral, cancellous and cortical segments of the regions analysed and modeled using linear or bi-linear (split plot) models using goodness-of-fit criteria without specification of the crossing point.

Results: Integral volume at the FN, TR and IT sites expanded linearly from 20-99y by 18%, 37% and 31%, respectively. Cancellous volume expansion was substantially larger by 65% and 79% respectively. FN cortical volume and mass decreased linearly by 43% and 45%, respectively. At the TR and IT sites, there was little loss in cortical volume and mass until mid-life. Over the life span a loss of 54% and 44% of cortical volume and mass, respectively, occurred at the TR site and a loss of 28% and 31%, respectively, at the IT site. The true volumetric density of the cortex decreased slightly but the cancellous bone density at the FN, TR and IT sites decreased by 50%, 34% and 44%, respectively.

Conclusion: The large periosteal expansion would be expected to increase bending strength and thus reduce failure in bending whilst cortical thinning would be expected to increase fracturing initiated by buckling. Substantial endosteal expansion and reduction in cancellous density would be expected to lead to prosthetic loosening over time.

IBDW2014-00098-F0029 BONE MINERAL DENSITY MEASUREMENT BY DUAL ENERGY X-RAY ABSORPTIOmetry IN YOUNG HONG KONG CHINESE

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Introduction and aims: Osteoporosis is a silent disease that usually concerns the elderly and develops after the age of 50, especially in perimenopausal women. Young adults reach peak bone mass by the age of 30, after which a process of gradual decline begins. There are many biological and environmental factors that contribute to the decline including gender, hormonal changes, dietary intake and physical exercise. The aim of this study is to investigate the bone mineral density (BMD) of the young Hong Kong Chinese by using Dual-energy X-Ray Absorptiometry (DXA).

Methods: We measured the BMD of eight young and healthy adults between the age of 18 to 21 years old (three males and five females). The lumbar spine (L1 – L4) and the left hip including the neck of the femur were examined and chosen for comparison. T- and Z-Scores derived from the BMD measurements were recorded and analyzed.

Results: In line with previous studies, we found that T-Scores comparing BMD to those of a 30 year old reference population at peak bone mass differed substantially from Z-Scores which also adjust for age, warranting a careful examination of both values. Based on the Z-Scores alone, all but one of the measurements were categorized as normal BMD (Z > -1.0). However, two of the young volunteers were diagnosed with osteopenia according to World Health Organisation (WHO) guidelines because of a T-score in the range of -2.5 < T < -1.0. The female volunteer with a low bone mass according to the Z-Score additionally indicated a family history of osteoporosis and will be alerted of her classification for further precautions and treatment.

Conclusion: DXA has been recognized as a “gold standard” technique that proves to be precise and accurate for measuring BMD, lending credibility to our results. Two out of the eight young adults were diagnosed with osteopenia. Osteopenia will eventually proceed into osteoporosis; therefore early awareness is crucial in preventing the risk of fractures. In consequence, we speculate whether DXA can be introduced to the general public instead of only being used as a diagnostic tool for potentially high risk patients.

IBDW2014-00099-F0030 EFFECT OF TWO TRAINING PROGRAMS ON BONE MINERAL DENSITY PARAMETERS IN CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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Introduction and aims: Chronic obstructive pulmonary disease (COPD) is associated with reduced bone mineral density (BMD) and osteoporosis.

Abstracts