In vivo measures of cartilage deformation: patterns in healthy and osteoarthritic female knees using 3T MR imaging.

To explore and to compare the magnitude and spatial pattern of in vivo femorotibial cartilage deformation in healthy and in osteoarthritic (OA) knees. One knee each in 30 women (age: 55 ± 6 years; BMI: 28 ± 2.4 kg/m²; 11 healthy and 19 with radiographic femorotibial OA) was examined at 3Tesla using a coronal fat-suppressed gradient echo SPGR sequence. Regional and subregional femorotibial cartilage thickness was determined under unloaded and loaded conditions, with 50% body weight being applied to the knee in 20° knee flexion during imaging. Cartilage became significantly (p< 0.05) thinner during loading in the medial tibia (-2.7%), the weight-bearing medial femur (-4.1%) and in the lateral tibia (-1.8%), but not in the lateral femur (+0.1%). The magnitude of deformation in the medial tibia and femur tended to be greater in osteoarthritic knees than in healthy knees. The subregional pattern of cartilage deformation was similar for the different stages of radiographic OA. Osteoarthritic cartilage tended to display greater deformation upon loading than healthy cartilage, suggesting that knee OA affects the mechanical properties of cartilage. The pattern of in vivo deformation indicated that cartilage loss in OA progression is mechanically driven.