

Application of μ CT in arthritis and osteoporosis research.

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ABSTRACT

Arthritis and osteoporosis are chronic disorders in which bone is dramatically affected. Bone erosion in the joints is a disabling hallmark of Rheumatoid Arthritis (RA) and Spondyloarthritis (SpA), two prototypic forms of chronic arthritis in men. In addition, bone new formation is a typical feature of SpA which can lead to ankylosis in some cases. Osteoporosis, on the other hand is a non-inflammation dependent bone disorder and the most significant underlying cause of skeletal fractures in postmenopausal women.

Experimental mouse models mimicking different characteristics of those disorders are being used to understand their pathology and to test treatments. Since decades two-dimensional sections by histology have been the gold standard to assess bone damage in these diseases (Seeuws *et al.* 2010). Recently, three-dimensional images can be produced by the application of micro Computed Tomography. High resolution μ CT has enabled us to visualise bone structure, bone erosion and bone new formation in great detail.

Samples were scanned at the Centre for X-Ray Tomography of the Ghent University (UGCT) on HECTOR (Masschaele *et al.* 2013). The resulting scan images have a voxel size of 4 micrometer. The obtained projection images were reconstructed using Octopus (Vlassenbroeck *et al.* 2007), a commercial software originally developed by UGCT. 3D visualisations were made using the commercial rendering software VGStudio_MAX. Bone parameters such as bone erosion, bone volume/total volume, cortical thickness, trabecular thickness and trabecular separation were calculated by an *in house* developed script using Image J. We have been able to use this *in house* script to accurately measure changes in bone parameters after ovariectomy in mice, mimicking postmenopausal osteoporosis. Evaluation of bone erosion in paws of mice after induction of arthritis and in conditions of increased or decreased biomechanical loading has highlighted a critical role for biomechanical stress in both models of RA and SpA (Jacques *et al.* 2014).

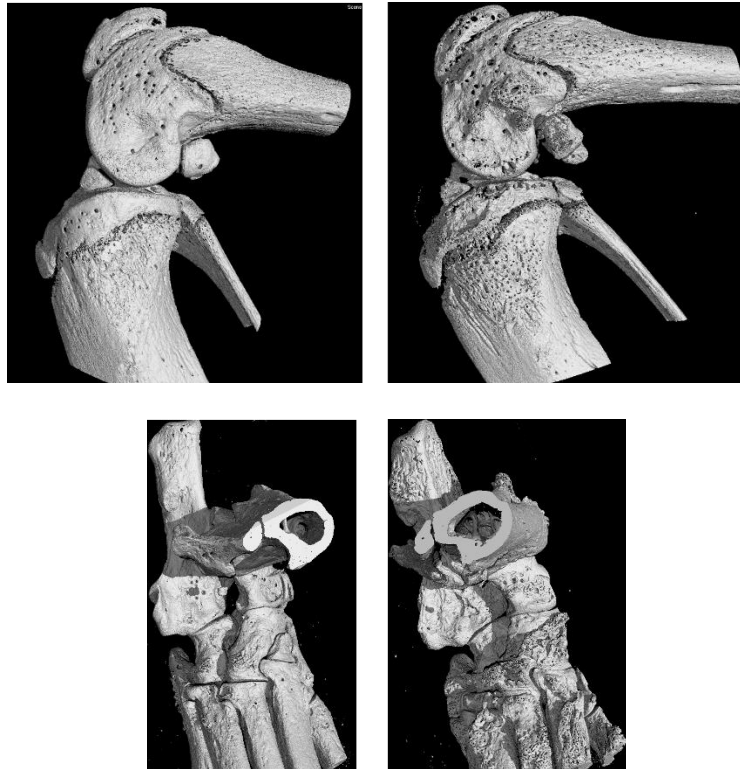


Figure 1: upper panel: 3D visualisation of microCT scans of knees of a mild arthritic (left) and a severe arthritic mouse (right). Lower panel: feet of control arthritic mouse (left) and arthritic mouse able to voluntary run in a running wheel (right), both feet had the same clinical inflammatory score.

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