Abstract:
Osteoporosis is classified as a public health problem due to its increased risk for fragility fractures. Osteoporotic fractures, in particular spine and hip fractures, are associated with a high morbidity and mortality, and generate immense financial cost. The World Health Organisation (WHO) based the diagnosis of osteoporosis on the measurement of bone mineral density (BMD) using dual-energy X-ray absorptiometry (DXA). However, BMD values of subjects with versus without osteoporotic fractures overlap. Furthermore, it was reported that the anti-fracture effects of drugs could be only partially explained by their effects on BMD. Bone strength reflects the integration of BMD and bone quality. The later can be partly determined by measurements of bone microstructure. Therefore, substantial research efforts have been undertaken to assess bone microstructure by using high-resolution imaging techniques, including high-resolution peripheral quantitative computed tomography (hr-pQCT), high-resolution multi-detector computed tomography (MDCT), and high-resolution magnetic resonance imaging (MRI). Clinical MDCT and MRI systems are broadly available and allow an adequate depiction of the bone microstructure at the clinically most important fracture sites, i.e. radius, spine and hip. Bone microstructure parameters and finite element models can be computed in high-resolution MDCT and MR images. These measurements
improved the prediction of bone strength beyond the DXA-derived BMD and revealed pharmacotherapy effects, which are partly not captured by BMD. Therefore, high-resolution bone imaging using clinical MDCT and MRI may be beneficial for osteoporosis diagnostics and allow a highly sensitive monitoring of drug treatment, which plays an important role in the prevention of fragility fractures.