Zn distribution in healing osteoporotic fractures measured by SR-µXRF analysis

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Bone has a remarkable ability for self-repair and regeneration after an injury and is able to completely restore its mechanical function on all levels of hierarchical structure. As healing progresses, the newly formed bone is remodeled from loosely organized woven bone into highly organized lamellar bone [1].

Zn is known to be located in the reactive centers of various enzymes, which plays a major role in the mineralization process at sites where new bone formation occurs. In addition, increased Zn levels are supposed to increase the proliferation rate of osteoblasts [2] and may lead to a stimulation of bone formation in vitro and in vivo [3]. Consequently, Zn seems to play an essential role in bone formation and mineralization involving various pathways. We thus expected Zn levels be to elevated at sites and stages of extensive bone formation like in the case of fracture healing.

Vertebral compression fractures (VCFs) commonly occur in both elderly men and women with osteoporosis. Two forms of therapy for patients with symptomatic osteoporotic vertebral compression fractures are balloon kyphoplasty and vertebroplasty [4]. Both techniques provide the possibility to obtain biopsy samples from VCFs prior to the bone cement injection [5]. Five of these biopsy samples were investigated in the course of this study. The samples were measured with a confocal synchrotron radiation micro X-ray fluorescence analysis (SR-µXRF) with a 10 µm x 15 µm resolution at the FLUO beamline at ANKA. As we found increased Zn levels which seemed to be accumulated in thin lines between bone packages we also investigated two sample areas with a higher resolution of 1 µm x 1 µm at B16 at Diamond. Results from both setups will be presented.

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