

Black Forest Forum
May 10-13, 2007
Castle Bad Liebenzell, Germany

Differences in zinc status, bone turnover and femoral head bone density and biomechanical properties between patients with osteoarthritis and osteoporosis

J.S. Thomsen¹, P.T. Nielsen², P.H. Christensen², O. Simonsen², H.C. Hoeck³,
M.B. Laursen², B. Møller-Madsen⁴, J. Ovesen⁵

¹Institute of Anatomy, University of Aarhus, Denmark; ²Orthopaedic Division, North Denmark Region, University of Aarhus, Aalborg, Denmark; ³Center for Clinical & Basic Research A/S, Aalborg, Denmark; ⁴Department of Orthopaedic Surgery, Aarhus University Hospital, Denmark; ⁵Department of Orthopaedic Surgery, Randers Regional Hospital, Denmark

Keywords: Zinc, Osteoarthritis, Osteoporosis, Bone Strength, Bone Density

Zinc has been suggested to play an important role in the development of osteoporosis (OP) and osteoporotic fractures, whereas the influence of zinc on osteoarthritis (OA) has attracted much less attention. Therefore, the purpose of this study was to investigate and compare the zinc status, bone turnover, and femoral head subchondral trabecular bone density, quality, and biomechanical properties of OA and OP patients undergoing hip-replacement.

The study comprised 40 women who underwent either a total hip-arthroplasty for OA ($n=20$, aged 71.7-89.6 years) or a hemi-arthroplasty following a fractured femoral neck due to OP ($n=20$, aged 70.4-91.3 years). During the operation, the femoral heads were obtained and subsequently 3 subchondral trabecular bone biopsies were drilled from each bone specimen. The unaffected hip and the exarticulated affected femoral head underwent DEXA scanning. Serum osteocalcin, crosslaps (CTX-I), and zinc concentrations as well as urine creatinine, CTX-I/creatinine, and zinc/creatinine concentrations were determined. The bone biopsies were biomechanically tested in a materials testing machine,

and maximum stress, Young's modulus, energy absorption, and strain were determined. The bone density of the biopsies was determined by ashing.

The strength, stiffness, energy absorption, and density of femoral head subchondral trabecular bone were significantly higher in OA patients than in OP patients. The quality of the subchondral trabecular bone was similar for OA and OP patients. The OP patients exhibited significantly higher bone resorption than OA patients, whereas the bone formation marker was similar in the two patient groups. OA patients had significantly higher serum zinc concentrations and significantly lower urine zinc concentrations than OP patients, whereas the bone zinc content did not differ.

In conclusion, OA femoral head trabecular bone is stronger, stiffer, and denser than OP bone, whereas the bone quality does not differ. The study confirms the present view that OP and OA are inversely related. In particular, the finding that the zinc status of OP patients is significantly different from that of OA patients is new and adds further support to the view that osteoporosis and osteoarthritis rarely occur in the same individual.

The authors have no conflict of interest.

Corresponding author: J.S. Thomsen, Department of Connective Tissue Biology, Institute of Anatomy, University of Aarhus, DK-8000 Aarhus C, Denmark
E-mail: jesper@jst.ana.au.dk

Accepted 1 June 2007