RESEARCH ARTICLE

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Buds of new bone formation within the Femoral Head of Hip Fracture Patients Coincide with Zones of Low Osteocyte Sclerostin

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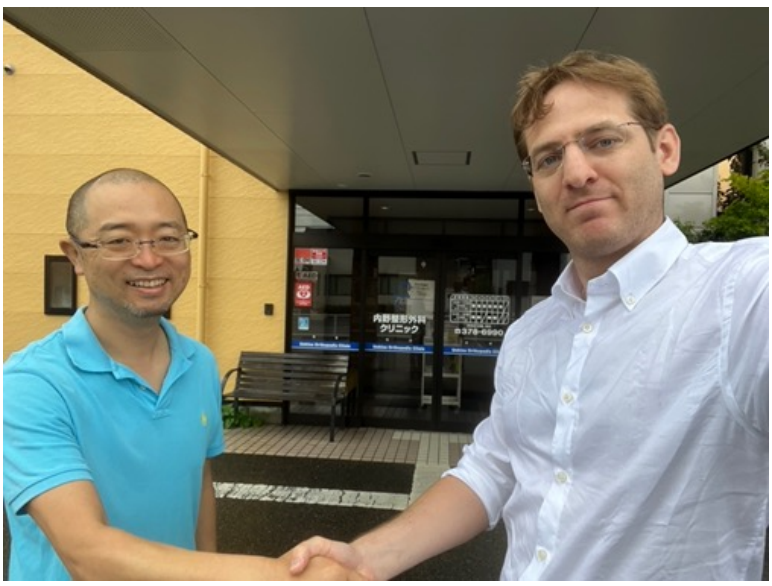
ABSTRACT

Romosozumab treatment reduces the rate of hip fractures and increases hip bone density, increasing bone formation by inhibiting sclerostin protein. We studied the normal pattern of bone formation and osteocyte expression in the human proximal femur because it is relevant to both antisclerostin treatment effects and fracture. Having visualized and quantified buds of new bone formation in trabeculae, we hypothesized that they would coincide with areas of (a) higher mechanical stress and (b) low sclerostin expression by osteocytes. In patients with hip fracture, we visualized each bud of active modeling-based formation (forming minimodeling structure [FMiS]) in trabecular cores taken from different parts of the femoral head. Trabecular bone structure was also measured with high-resolution imaging. More buds of new bone formation (by volume) were present in the higher stress superomedial zone (FMiS density, N.FMiS/T.Ar) than lower stress superolateral ($p < 0.05$), and inferomedial ($p < 0.001$) regions. There were fewer sclerostin expressing osteocytes close to or within FMiS. FMiS density correlated with greater amount, thickness, number, and connectivity of trabeculae (bone volume BV/TV, $r = 0.65$, $p < 0.0001$; bone surface BS/TV, $r = 0.47$, $p < 0.01$; trabecular thickness Tb.Th, $r = 0.55$, $p < 0.001$; trabecular number Tb.N, $r = 0.47$, $p < 0.01$; and connectivity density Conn.D, $r = 0.40$, $p < 0.05$) and lower trabecular separation (Tb.Sp, $r = -0.56$, $p < 0.001$). These results demonstrate modeling-based bone formation in femoral trabeculae from patients with hip fracture as a potential therapeutic target to enhance bone structure. © 2023 American Society for Bone and Mineral Research (ASBMR).

KEY WORDS: MODELING-BASED BONE FORMATION; FORMING MINIMODELING STRUCTURES; FEMORAL HEAD; BONE HISTOMORPHOMETRY; FEMORAL NECK FRACTURE



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