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In situ tissue engineering using an induced adipose tissue to regenerate bone

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It is known that disturbances of the balance between osteogenesis and adipogenesis lead to metabolic diseases such as osteoporosis. Several studies have reported that induction of adipose tissues in bone marrow leads to decreased bone mass and bone formation suggesting that bone marrow osteogenesis and adipogenesis are inverse processes.

In this preliminary study we were testing the hypotheses of induction of adipose tissue to form bone using bioceramic material, rat mesenchymal stromal (rMSCs) cells and bone morphogenetic protein-2 (BMP-2) in ex vivo experiments. hMSC-TERT cell line was used to test the interconversion cell process. Osteogenic and adipogenic trans-differentiation was assessed for the same culture cell line. The osteogenic and adipogenic differentiation were confirmed by applying the following assays: ALP staining, Nile Red Staining & Quantitative Real Time PCR (qRT-PCR). For in vivo, 5 bone cement construct were prepared, using injectable calcium sulphate/hydroxy appetite of 60% calcium sulfate, 40% hydroxyapatite powder (CS/HA) and B 0.13 mg of bone cement of one morphogenic protein-2 (BMP-2, then injected bilaterally at abdominal fat tissues in Sprague Dawley male rats (n=5). Eight weeks postoperative histological assessment for the harvested adipose tissues showed, immature bone formation with osteocyte was noted. Area of cartilage tissues and chondrocytes were found with close approximation to the injected bone cement CS/HA formation. The findings indicate osteogenic differentiation of fat cells occurs under the effect of bio-ceramic and bone morphogenic protein which were injected in situ. Interestingly, presence of chondrocytes and premature cartilage tissue could indicate endochondral bone formation. This study confirms the in vivo trans-differentiation of adipose tissues and suggests novel strategies for bone regeneration.

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