รายงานวิจัยฉบับสมบูรณ์

ชื่อโครงการ

Effects of basic fibroblast growth factor (FGF2) and LIM mineralization protein-1 (LMP1) on mesenchymal cell differentiation and bone regeneration

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ประเภทความร่วมมือกับต่างประเทศ

Sequential induction of marrow stromal cells by FGF2 and BMP2 improves their growth and differentiation potential *in vivo*

Abstract

Background: To repair bone loss by autogenous grafting, marrow stromal cells (MSCs) of a patient himself need to be expanded *in vitro* for sufficient use in implantation. However, the technique is limited by restricted osteoblasts found among heterogeneous phenotypes of MSCs. The proliferation rate and bone forming efficiency are also deteriorated upon *in vitro* expansion.

Objective: To establish culture conditions that permit rapid expansion of the cells *in vitro*, and retain their potential for complete differentiation *in vivo*.

Results: Improved growth and differentiation potential of MSCs were achieved by sequential induction with FGF2 and BMP2 at reduced doses. FGF2 stimulated the expression of Cbfa1/Runx2 gene and increased the sensitivity of cells to BMP2. While BMP2 increased the syntheses of ALP, collagen type I and bone sialoprotein. Increased expression of OC was more affected by FGF2 than BMP2. Full induction as determined by the formation of mineralized nodules *in vitro* was detected within 7 days. By seeding the induced cells onto scaffolds and ectopically implanted into nude mice, newly formed bone was demonstrated at 4 weeks after implantation. The results suggested that FGF2 increased the pool of committed osteoblasts by up-regulating the expression of Cbfa1/Runx2 gene, while the following stages of bone formation seemed to be responsible by Cbfa1/Runx2-related down streamed factors such as BMP2, ALP, collagen type I, bone sialoprotein and OC.

Conclusion: The established culture system required a short time period in preparing pre-osteoblasts. It might be beneficial for bone tissue engineering.

Keywords:

Marrow stromal cells (MSCs), basic fibroblast growth factor (FGF2), bone morphogenetic protein 2 (BMP2), Cbfa1/Runx2, ectopic bone formation