

Mesenchymal Stem Cells Pre-exposed to Basic Fibroblast Growth Factor Did Not Enhance Additional Bone Formation in Posterior Spinal Fusion

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Basic fibroblast growth factor (bFGF) has been shown to maintain the osteogenicity of bone marrow derived mesenchymal stem cell (MSCs) *in vitro*. This study is to investigate whether bFGF with osteogenic supplements could further enhance bone formation of posterior spinal fusion in an undecorticated model.

Rabbit bone marrow was aspirated from proximal femur. Bone marrow derived mesenchymal stem cells were selected by adherence on plastic culture-ware. The MSCs were treated by dexamethasone with (bFGF group, n=6) or without bFGF (OS group, n=6). Treated cells of two groups were loaded on beta-tricalcium phosphate ceramics and cultured for one day. The cell-ceramics composite was implanted onto L5 and L6 transverse processes of the same animal in posterior spinal fusion without decortication. The ceramics acted as control (n=6). Three fluorochromes were injected sequentially as tetracycline at week 2, xylenol orange at week 4 and calcein at week 6. The spinal segments were harvested at week 7. The bone mineral content (BMC) and volume of transverse processes was measured by peripheral quantitative computed tomography. The specimens were underwent undecalcified histology. The mineralization process was examined by fluorescent microscopy.

The BMC of transverse processes in OS group was found to be 16% greater than bFGF and control group significantly. The volume of transverse process in OS and bFGF group was significantly greater than control group by 54%

and 46% respectively. The volume of transverse processes in OS group was 6% greater than bFGF group though not statistically significant. In histology, newly formed bone grew from two processes towards each other resulting in a relatively short gap distance in OS and bFGF group while less regenerated bone was observed in the control group. At the mineralization front, calcein which was injected into animal at week 6, was predominately labeled in bFGF group. In OS group, both xylenol orange (at week 4) and calcein labeled were found.

The MSCs were induced by osteogenic supplement to give active bone formation and promote bone remodeling during process of spinal fusion as shown by fluorescent microscopy. The bFGF with osteogenic supplements treated MSCs enhanced bone regeneration mainly on week 6. The bone formation of bFGF group might be slower than OS group. The bFGF with osteogenic supplements treated MSCs might be quite primitive in osteogenic lineage. The morphology of them was spindle shaped, like untreated mesenchymal stem cell in cell culture. They might take time to differentiate into mature osteogenic cells after implantation. Moreover, they might be able to differentiate into other cell types depending on the micro-environment *in vivo*.

In conclusion, mesenchymal stem cells pre-exposed to bFGF were not found to have additional enhancement effect on bone formation in the posterior spinal fusion model.