Effects of Sub-Sonic Vibration on the Proliferation and Maturation of Preadipocyte 3T3-L1 Cells

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Introduction
Adipocytes play an important role in lipid homoeostasis and energy balance through triglyceride storage. Preadipocytes are undifferentiated fibroblasts that can be stimulated to form adipocytes. Sub-Sonic Vibration (SSV) has been shown to be an effective means of treatment in vitro and in vivo. Additionally, there is evidence that vibration has anabolic effects and is an instructive effector of bone formation. In this study the effects of SSV on the regulation of preadipocyte maturation were investigated based on the expression of PPAR-γ and C/EBP-α. And a BrdU assay was conducted to evaluate the effects of SSV on proliferation of 3T3-L1 cells. Mechanical stimulation like SSV could have potential to control cell fate.

Materials and Methods
3T3-L1 mouse embryo fibroblasts were obtained from the American Type Culture Collection (ATCC, Washington, America). The Turbosonic apparatus (Turbosonic Korea, Seoul, Korea) was used to produce sonic. The motion of sub-sonic vibration is horizontal. The instrumentation is in incubator, so this study performed in incubator. For analysis of gene expression, we performed RT-PCR.

Results
SSV inhibited proliferation of 3T3-L1 cells. The impact of SSV on 3T3-L1 preadipocytes proliferation was assessed by BrdU assays. As shown in Fig. 1, after 2 days of culture, SSV inhibited the proliferation of 3T3-L1 preadipocytes at frequencies of 10 to 30 Hz. Preadipocyte proliferation was significantly reduced at 20 Hz. These results on day 3 were similar to that of day 2 of culture, which indicates that preadipocyte proliferation was inhibited at 20 Hz with effect.

SSV promoted maturation of 3T3-L1 cells
To determine the effect of SSV on preadipocytes maturation, we analyzed gene expression. SSV enhanced C/EBP-α and PPAR-γ at 20 and 30 Hz after maturation for 6 days post SSV. The highest C/EBP-α and PPAR-γ mRNA expression was 30 Hz group: approximately 1.6 and 1.5 fold higher respectively.

Fig. 2. Adipogenic gene expression detected by RT-PCR in matured 3T3-L1 cells after SSV on day 6.

Discussion and Conclusions
Mechanical stimulation is essential regulators of tissue homeostasis and indispensable for normal function particularly of connective tissues. But a great amount of studies have focused on mechanical stimulation on proliferation and differentiation of bone progenitor cells. We thought that this study is basis data for research of SSV of other cells. In this study, we demonstrated that the SSV at frequencies of 20 and 30 Hz inhibited the proliferation of preadipocytes and enhanced the maturation of adipocytes. We suggested that SSV seemed to control the fate of preadipocyte through the regulation of gene expression like PPARγ and CEBP/α.

References

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Disclosures: ok