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Low-Intensity Ultrasound Increased Colony Forming Unit-Fibroblasts of Mesenchymal Stem Cells During Primary Culture

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ABSTRACT

Mesenchymal stem cells (MSCs) from bone marrow (BM) are an attractive cell source for stem cell-based therapeutic applications, but they exist at low-end ratios, which further decreases along with increased donor age. Thus, for clinical applications, there is a high demand for large numbers of active MSCs. This study investigated if low-intensity ultrasound (LIUS), a special type of mechanical stimulation, could increase the yield of MSCs during primary culture from the BM. Cultures were treated with LIUS for 10 min/day during the first 6 days after initial plating of BM mononuclear cells. After 12 days, the colony-forming unit-fibroblasts assay was performed, and the colonies were culture-expanded for further analyses. The LIUS stimulation showed a significant increase in the number of MSCs colonies when compared with that of the control group. The LIUS-stimulated MSCs showed no difference compared with the untreated control MSCs in terms of their proliferation rate, expression of MSCs-enriched surface antigens, and multi-lineage differentiation ability. The LIUS stimulation also showed an increase in

the expression of integrins, fibronectin, and paxillin, and induced the formation of focal adhesions in MSCs, all of which involved in the cell adhesion process. These results demonstrated that LIUS stimulation could activate the cell adhesion process and increase the colony-forming ability of MSCs during the early stage of primary culture, without affecting their phenotypes and multi-potency. The results of this study suggest that LIUS could be a useful tool to obtain a large amount of MSCs for various therapeutic applications.

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