

Focused Extracorporeal Shock Waves Influence Migration, Proliferation and Growth of Human Mesenchymal Stem Cells

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Device and producing company:

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Introduction:

Mechanotransduction leads to transformation of mechanical sensations into cellular impulses. The routes of these impulses are time-dependent in different supporting connective tissue. These routes induce a certain flow direction of information. There are arising follow-up signals, which are considered as biological information units, leading to very specific signals and thus to equally specific biological transformation within the cellular structure. The adherence to precise methods of application by means of mechanical stimulus is of utmost importance. For the first time we were able to prove that mechanical activation of stem cells is possible with the help of extracorporeal shock waves, hereby establishing further therapy methods.

Methods:

The needed mesenchymal stem cells were aspirated from the femur bonemarrow, filtered and centrifugated. The enriched cells were subjected by microscopic assessment of morphology (Flow cytometry, CFU-assay, differentiation assay). The differentiation potential of MSCs was controlled by culturing the cells under conditions that were favourable for adipogenic, osteogenic and chondrogenic differentiation. Shock waves were applied to adherent MSCs. In order to imitate natural application in in vivo culture dishes were completely filled with media and covered with freshly prepared pork skin. Ultrasound gel was placed on top of the pork skin to ensure best adjustment to the shock wave system. We controlled the migration, growth and proliferation under shock wave influence.

Results:

We could show that shock waves increase the migratory activity of MSCs when used under distinct conditions. They increase significantly MSC growth in the first passage after treatment and they increase also MSC proliferation.

Discussion: The strong effects of shock waves on MSCs indicate that these cells can be influenced by mechanical stimuli.

Conclusion: The results of shock wave treatment depend on number of applications, frequency and density of energy; they might be the first approach to mobilize stem cells noninvasively.