Mesenchymal stem cells differentiation into cardiac linage on modified nanofiber scaffold

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The cardiovascular disease and death has led researchers to look beyond pharmaceutical standards of care to new cell-based therapies that may benefit patients. Annually in the United States alone 600,000 people die of heart disease. The innovation is to use the modified nanofiber scaffold and (hBMSC) human bone marrow derived stem cells as a regenerative medicine strategy to replace damaged cardiac tissue after traumatic events such as a heart attack . The induced pluripotent stem cells (iPSCs) allows the development of beating cardiac tissue in vitro. Recent research has demonstrated two advances in hBMSC therapy for cardiac healing: first, priming the cells in vitro for eventual transplantation aides cell survival and terminal differentiation once deposited to the cardiac niche and second, paracrine factors produced by hBMSCs while differentiating in culture. These discoveries lead us to develop the modified nanofiber scaffold based hBMSc to differentiate in to cardio myocytes to repair the damaged heart. Cell-based therapies as treatment for MI (Myocardial Infraction) have demonstrated safety in vivo but mixed efficacy. We developed an adjustable rat model of MI (Myocardial Infraction) to test the therapeutic effectiveness of intracardiac injections of hBMSCs primed on protein- and small molecule-coated nanoscaffolds which has demonstrated increased cardiac biomarker expression and decreased canonical WNT signaling. Myocardial infraction (MI) rat model to mimic the human MI conditions is created by subcutaneous administration of isoproterenol resulted in dose dependent myocardial damage. After intracardiac injections, hBMSCs combined with nanofiber scaffold engrafted within the heart and provided increased EF in animals given low and medium/ high cardiac damage, compared to sham operated rats. These results demonstrate stem cells based therapies are not conducive to all levels of MI severity, and future stem cell trials will be aided by standardizing definitions of cardiac improvement.

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