Current post-infarct treatments have reduced mortality but there is still no effective method supporting myocardial healing. One major limitation is the loss of tissue-resident macrophages (M2) which are key cells to promote remodeling. We proposed to evaluate oriented fibrous substrates for supporting M2 polarization. Anisotropic surfaces have been shown to influence macrophage polarization state. We hypothesized that the use of an anisotropic collagen fibrous patch will promote M2-polarization.

The polarization status of THP-1 was examined on electrospun Polycaprolactone (PCL) or collagen type I substrates grouped based on the level of orientation confirmed by analysis of SEM images. Gelatin-based coating, tissue culture plastic and double sided medical-grade tape were used as surface controls. Phorbol myristate acetate (PMA) treatment and cytokine cocktails were used as controls for macrophage differentiation/polarization. Gene expression levels of CCR7 and CD206/CD163 receptors were measured to distinguish among M1/M2 polarization. Compared to tissue culture plastic, M2 polarization in aligned collagen membranes showed up to a 1000-fold increase for CD206 expression and expression of CD163 in gelatin-based coating decreased 0.8-fold (p<0.01). Moreover, spontaneous polarization to M2 phenotype was detected in aligned collagen membranes and PCL fibers. Gelatin-based coating did not support M2 polarization, indicating that effects are not dependent on integrin mediated cell adhesion to RGD binding sites. This demonstrate that anisotropic substrates support polarization to M2 phenotype. The data obtained will be used to support the use of fibrous substrates for tissue remodeling and delivery of cardiomyocytes after a myocardial infarction.