Cardiac myocyte force development during differentiation and maturation.

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Authors: Jeffrey G Jacot, Hiroko Kita-Matsuo, Karen A Wei, H S Vincent Chen, Jeffrey H Omens, Mark Mercola, Andrew D McCulloch

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Public Summary:

Scientific Abstract:
The maturation of cardiac myocytes during the immediate prenatal period coincides with changes in the mechanical properties of the extracellular matrix. We investigated the effects of extracellular stiffness on cardiomyocyte maturation in neonatal rat ventricular myocytes grown on collagen-coated gels. Cells on 10-kPa substrates developed aligned sarcomeres, while cells on stiffer substrates had unaligned sarcomeres and stress fibers. Cells generated greater mechanical force on gels with stiffness similar to that of the native myocardium than on stiffer or softer substrates. To investigate the differentiation of myocyte progenitors, we used clonal expansion of engineered human embryonic stem cells. Puromycin-selected cardiomyocytes exhibited a gene expression profile similar to that of adult human cardiomyocytes and generated force and action potentials consistent with normal fetal cardiomyocytes. These results suggest that extracellular stiffness significantly affects maturation and differentiation of immature ventricular myocytes.