Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Measuring the correlation between cell mechanics and myofibroblastic differentiation during maturation of 3D microtissues[1] RUOGANG ZHAO, WEIGANG WANG, Johns Hopkins University, THOMAS BOUDOU, CHRISTOPHER CHEN, University of Pennsylvania, DANIEL REICH, Johns Hopkins University — Tissue stiffness and cellular contractility are two of the most important biomechanical factors regulating pathological transitions of encapsulated cells, such as the differentiation of fibroblasts into myofibroblasts - a key event contributing to tissue fibrosis. However, a quantitative correlation between tissue stiffness and cellular contraction and myofibroblast differentiation has not yet been established in 3D environments, mainly due to the lack of suitable 3D tissue culture models that allow both tissue remodeling and simultaneous measurement of the cell/tissue mechanics. To address this, we have developed a magnetic microtissue tester system that allows the remodeling of arrays of cell-laden 3D collagen microtissues and the measurement of cell and tissue mechanics using magnetically actuated elastomeric microcantilevers. By measuring the development of cell/tissue mechanical properties and the expression level of α-smooth muscle actin (α-SMA, a marker for myofibroblast differentiation) during a 6 day culture period, we found microtissue stiffness increased by 45% and α-SMA expression increased by 38%, but tissue contraction forces only increased by 10%, indicating that tissue stiffness may be the predominant mechanical factor for regulation of myofibroblast differentiation. This study provides new quantitative insight into the regulatory effect of cell and tissue mechanics on cellular function.

[1]Supported in part by NIH grant HL090747

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Date submitted: 09 Nov 2012 Electronic form version 1.4