Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Micromechanics of cellularized collagen I networks CHRISTOPHER JONES, MATT CIBULA, DAVID MCINTYRE, BO SUN, Oregon State Univ — Collagen gels are commonly used in experiments on cell mechanics because collagen is the most abundant protein in the mammalian extracellular matrix. Collagen gels are often approximated as homogeneous elastic materials; however, variations in the collagen fiber microstructure and cell adhesion forces cause the mechanical properties to be inhomogeneous at the cellular scale. We study the mechanics of type I collagen on the scale of tens to hundreds of microns by using holographic optical tweezers (HOT) to apply pN forces to micron-sized particles embedded in the collagen fiber network. We calculate the local compliance and elastic modulus of the collagen network and find that particle displacements are inhomogeneous, anisotropic, and often have components perpendicular to the direction of the applied force. Confocal reflection microscopy (CRM) is used to reveal the local fiber structure and a simulation treating fibers as rigid rods is used for comparison to the HOT measurements. Collagen samples prepared at 21°C and 37°C show that gels formed at lower temperature are more inhomogeneous, anisotropic, and compliant than those formed at high temperature, and cellularized samples allow us to characterize the effects of cell adhesion forces on the network mechanics.

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Date submitted: 14 Nov 2014 Electronic form version 1.4