The Effects of Exogenous Extracellular Matrix and Substrate Stiffness on Mouse Tendon Cells In Vitro

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To improve the treatment of musculoskeletal injuries, a better understanding of the transitional environment in which progenitor cells form mature musculoskeletal constructs is necessary. This need arises because injury repair requires restructuring of tissue, similar to the initial tissue construction that occurs during embryonic development by progenitor cells. Differences in both the biochemical and mechanical environments between a transitional and a differentiated state are known to take place, but how these differences affect cell behavior had not yet been characterized in mammalian tendon cells. In order to investigate this, we have determined the effects of exogenous extracellular matrix and the effects of substrate stiffness on mice tendon cells. Cell behavior is evaluated according to changes in proliferation with respect to exogenous ECM - fibronectin, laminin, tenascin-C, and denatured collagen – and the stiffness of the culture substrate – 100Kpa, 35Kpa, 15Kpa, 2Kpa. This study indicates that tenascin-C and denatured collagen have significantly higher proliferation over a 24 hour period than either fibronectin or laminin. Additionally, cell proliferation with respect to substrate stiffness is significantly different between conditions; however, trends vary per ECM indicating that the biochemical and mechanical pathways that regulate cell proliferation are dependent and ECM specific. This study has elucidated the effects of biochemical and mechanical variations on mammalian tendon cells to provide insight into the nebulous behavioral differences between transitional and differentiated tissue.