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Viscoelastic Properties of Microgel Thin Films Control Fibroblast Modes of Migration and Pro-fibrotic Responses

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Abstract:

Cell behavior is influenced by the biophysical properties of their microenvironments, and the linear elastic properties of substrates strongly influences adhesion, migration, and differentiation responses. Because most biological tissues exhibit non-linear elastic properties, there is a growing interest in understanding how the viscous component of materials and tissues influences cell fate. Here we describe the use of microgel thin films with controllable non-linear elastic properties for investigating the role of material loss tangent on cell adhesion, migration, and myofibroblastic differentiation, which have implications in fibrotic responses. Fibroblast modes of migration are dictated by film loss tangent; high loss tangent induced ROCK-mediated amoeboid migration while low loss tangent induced Rac-mediated mesenchymal cell migration. Low loss tangent films were also associated with higher levels of myofibroblastic differentiation. These findings have implications in fibrosis and indicate that slight changes in tissue viscoelasticity following injury could contribute to early initiation of fibrotic related responses.