Cellular and nuclear mechanical properties probed by adhesion and de-adhesion dynamics

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Measurement of cellular and nuclear mechanical properties is of increasing interest both from a fundamental cell biological perspective and in the context of disease diagnostics. However, most of experimental techniques available to probe the mechanical properties of cells and nuclei (e.g. particle tracking, magnetic twisting cytometry, micropipette aspiration, microplates, optical and magnetic tweezers or atomic force microscopy) are invasive and thus can activate mechanotransduction pathways. In this communication, we show that tracking cell shape dynamics during (i) adhesion and (ii) de-adhesion can serve as simple but extremely accurate tool for probing simultaneously the cellular and nuclear mechanical properties. By using a wide range of micropatterned polyacrylamide stiffnesses, we show that adhesion and de-adhesion dynamics reflect the impact of the internal prestress on cellular and nuclear mechanical properties.