Electronic Supplementary Material (ESI) for Lab on a Chip.

Supplementary Information

Actuated 3D microgels for single cell mechanobiology

Berna Özkale,[ab] Junzhe Lou,[ab] Ece Özelçi,[c] Alberto Elosegui-Artola,[ab] Christina M. Tringides,[ab] Angelo S. Mao,[ab] Mahmut Selman Sakar*[c] and David J. Mooney*[ab]

[a] Harvard John A. Paulson School of Engineering and Applied Sciences, Harvard University, Cambridge, MA, 02138, USA

E-mail: selman.sakar@epfl.ch, mooneyd@seas.harvard.edu

[b] Wyss Institute for Biologically Inspired Engineering, Cambridge, MA, 02138, USA

[c] Institute of Mechanical Engineering and Institute of Bioengineering, Ecole Polytechnique Fédérale de Lausanne (EPFL), CH-1015, Lausanne, Switzerland

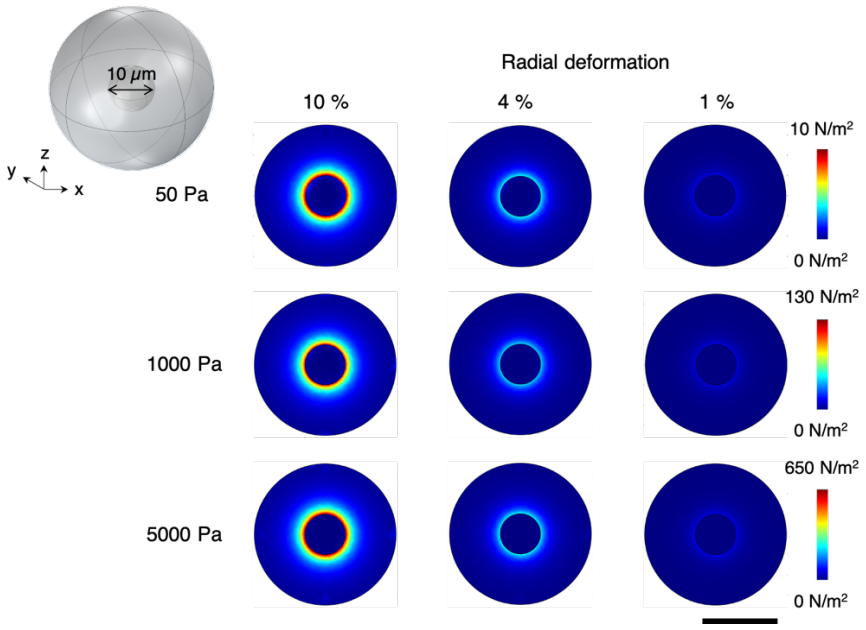

Figure S1. Cross-sectional stress maps for different cases of radial deformation and microgel Young's modulus calculated for 10 μm cell size (scale bar: 20 μm).

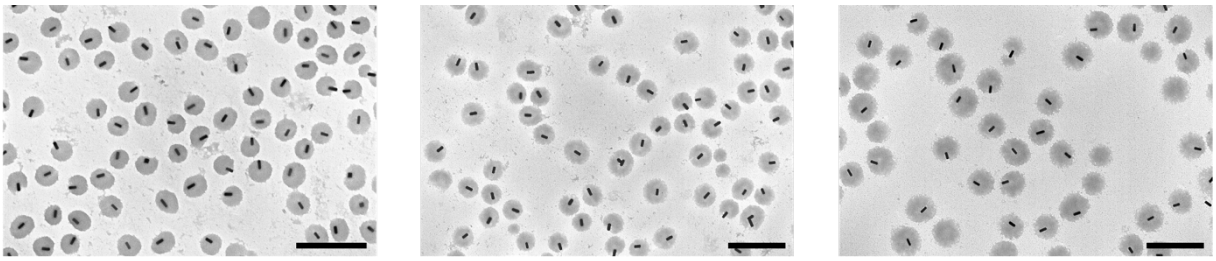

Figure S2. A series of representative TEM images of a large pool of nanoactuators (scale bar: 1 μm).

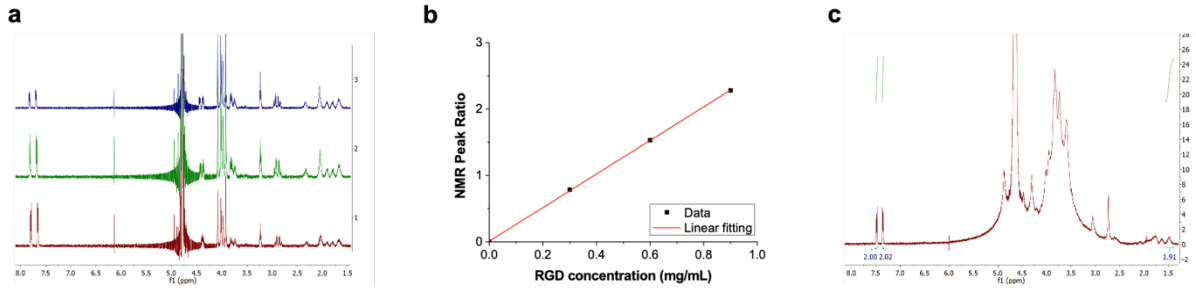

Figure S3. Quantification of RGD in RGD modified alginate. a) ^{1}H NMR spectra of RGD in D_2O containing 0.02 wt% KHP. Sample 1-3 contains 0.03, 0.06 and 0.09 wt% RGD

respectively, b) Standard calibration curve showing linear correlation between ^{1}H NMR peak area integration ratio of RGD/ KHP and RGD concentration, c) ^{1}H NMR spectra of alginate-RGD in D_2O containing 0.02 wt% KHP.

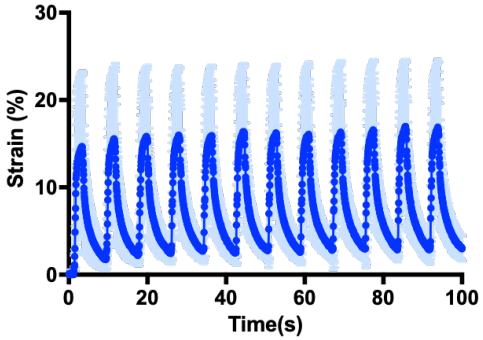

Figure S4. Cyclic actuation response of click modified dynamic microgels at 57 mg/ml HP concentration. Data shows average radial strain over 12 actuation cycles with 1 second on and 5 seconds off laser pulses while background highlighted areas show error bars (n=9).

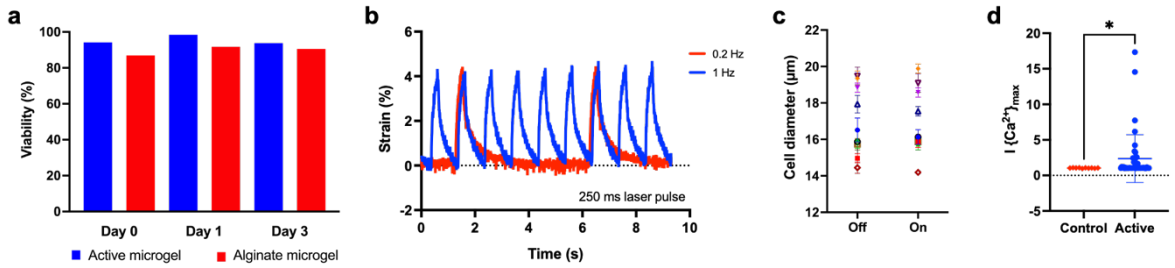

Figure S5. (a) Viability under static conditions monitored for 3 days in microgels with and without nanoactuators in the presence of cell adhesion peptide RGD. (b) Frequency response in cell encapsulated active microgels for 250 msec pulse duration. (c) Plot shows cell diameter before and during isotropic compression of 500 msec in active microgels (n=10). A total of ten images were analyzed per cell. (d) Comparison of maximum normalized intracellular calcium intensity in control (n=8) and active microgels (n=44), * indicates significant difference using unpaired t test with Welch's correction, $p<0.01$.