Supporting information

Characterization of the kinetics and mechanism of degradation of human mesenchymal stem cell-laden poly(ethylene glycol) hydrogels

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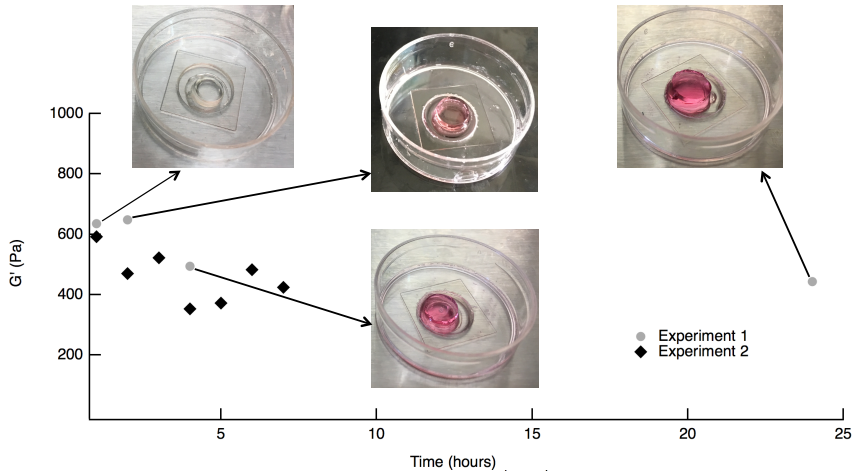

Figure S1: Hydrogel swelling, shown visually and quantified using bulk rheology. With swelling, hydrogels visibly increase in size and color as growth medium diffuses into the hydrogel. Note that the growth medium in our experiments is a reddish-pink color, and as growth medium diffuses into the hydrogel, the hydrogel also becomes a bright pink color. Hydrogel swelling is complete in approximately 4 hours and decreases the initial elastic moduli, G_0', of the scaffold.

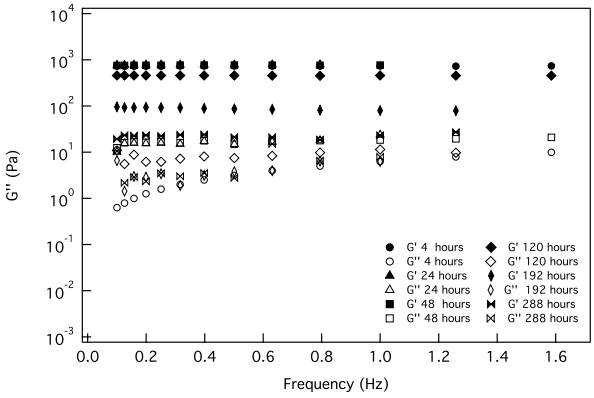

Figure S2: Changes in the elastic and loss modulus at different time point during hydrolysis of PEG-norbornene hydrogel without hMSCs.

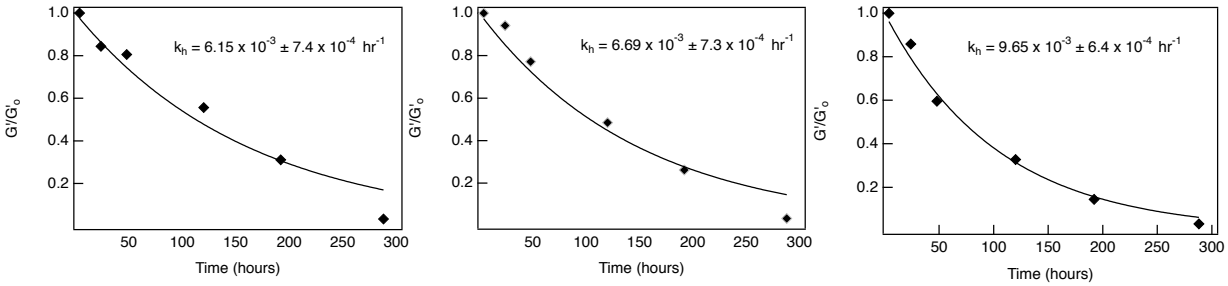

Figure S3: Normalized elastic moduli, G'/G'_0, as a function of time for hydrolysis of hydrogels without hMSCs. Hydrolysis follows first-order kinetics and the data for each experiment is fit to Equation 2. These graphs show the individual experiments and the resulting hydrolysis kinetic constant, k_h.

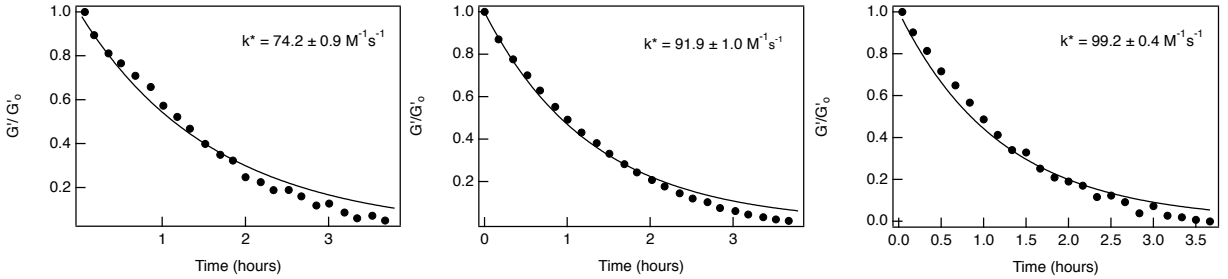

Figure S4: Normalized elastic moduli, G'/G'_0, as a function of time for individual non-cellular enzymatic degradation experiments degraded by a 0.3 mg/mL collagenase solution. The data is fit to Equation 3, which is based on Michaelis-Menten kinetics. The collagenase first-order rate constant, k_d, and initial concentration of collagenase, $[collagenase_0]$, equal 0.02 hr^{-1} and 2.31×10^{-6} M, respectively, as discussed in the main text. Using these constants and fitting the data to Equation 3, the enzymatic kinetic constant, k^*, is determined for each experiment.

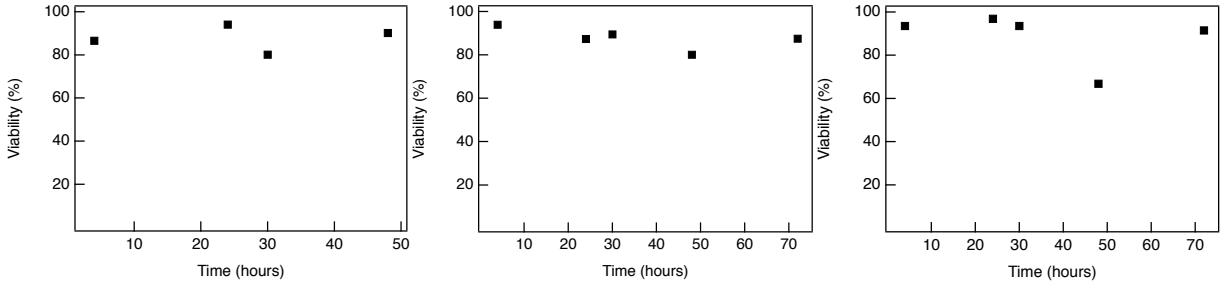

Figure S5: Individual experiments of sheared viability for hMSC-laden hydrogels. These graphs show hMSC viability as a function of time after hMSC-laden hydrogels are sheared on the rheometer.

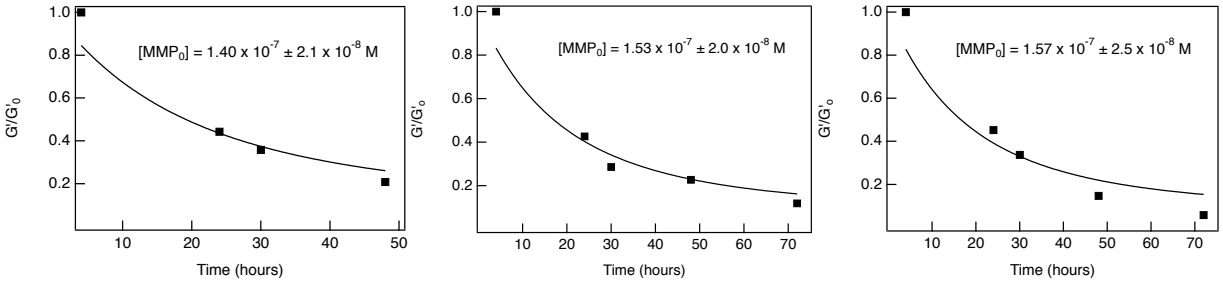

Figure S6: Normalized elastic moduli, G'/G'_0, as a function of time for individual cell-mediated degradation experiments. The data is fit to Equation 4, which is based on Michaelis-Menten kinetics. The first-order rate constant, k_d, and enzymatic kinetic constant, k^*, are determined in previous non-cellular degradation experiments, and are 0.02 hr^{-1} and 86.7 $\text{M}^{-1}\text{s}^{-1}$, respectively. Using these constants and fitting to Equation 4, the initial concentration of MMPs secreted by hMSCs, $[MMP_0]$, is determined for each measurement of hydrogels with an encapsulated hMSC concentration of 2×10^5 cells/mL.

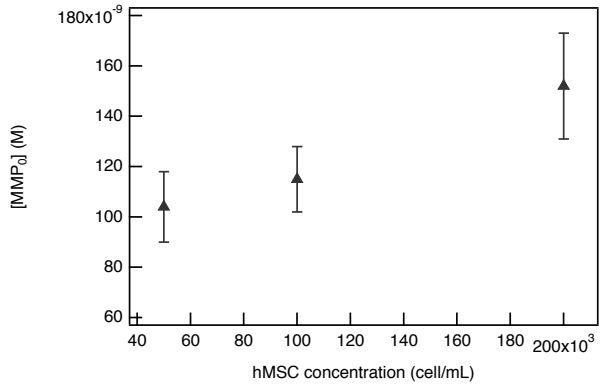

Figure S7: Initial concentration of MMPs secreted by hMSCs as a function of hMSC encapsulation concentration. When more hMSCs are encapsulated in these hydrogels, more MMPs are secreted by the cells, resulting in a higher MMP concentration in the hydrogel.