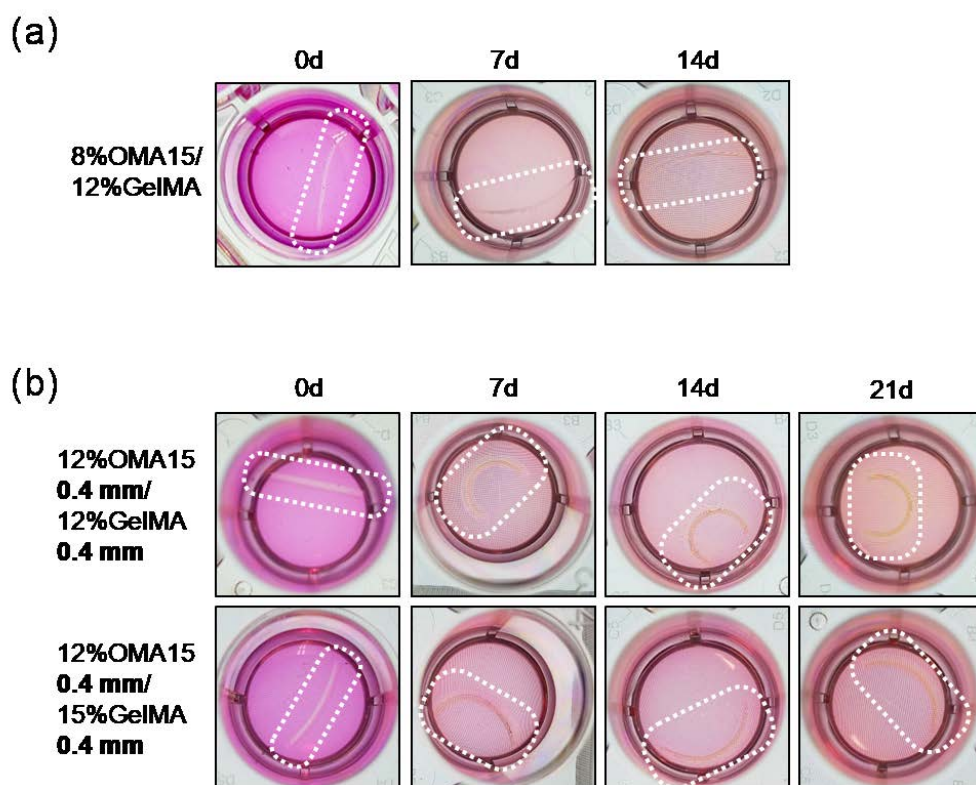
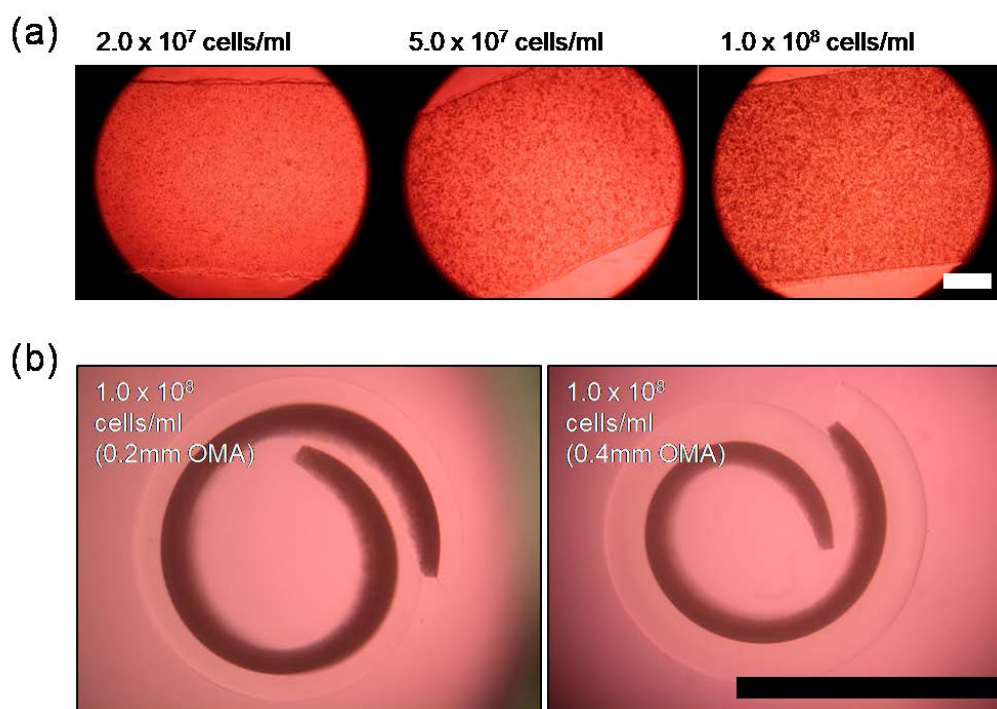


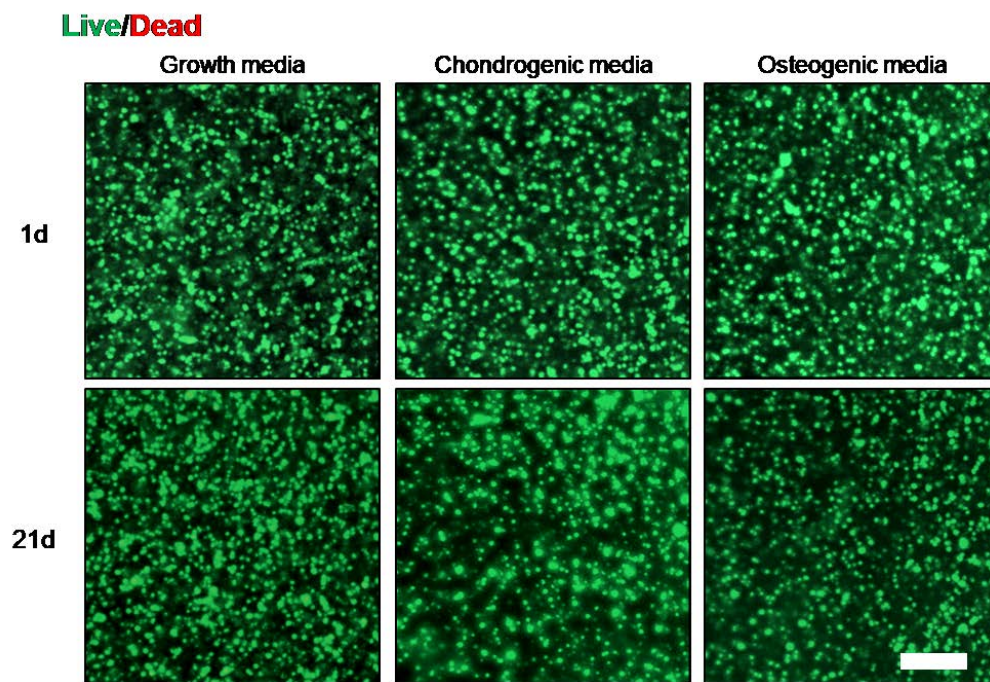
**Figure. S1.** (a) Illustration defining side and bird's eye views of the 4D constructs. (b) Illustration depicting angle measurements of the model constructs from the bird's eye view as a quantification of shape change.



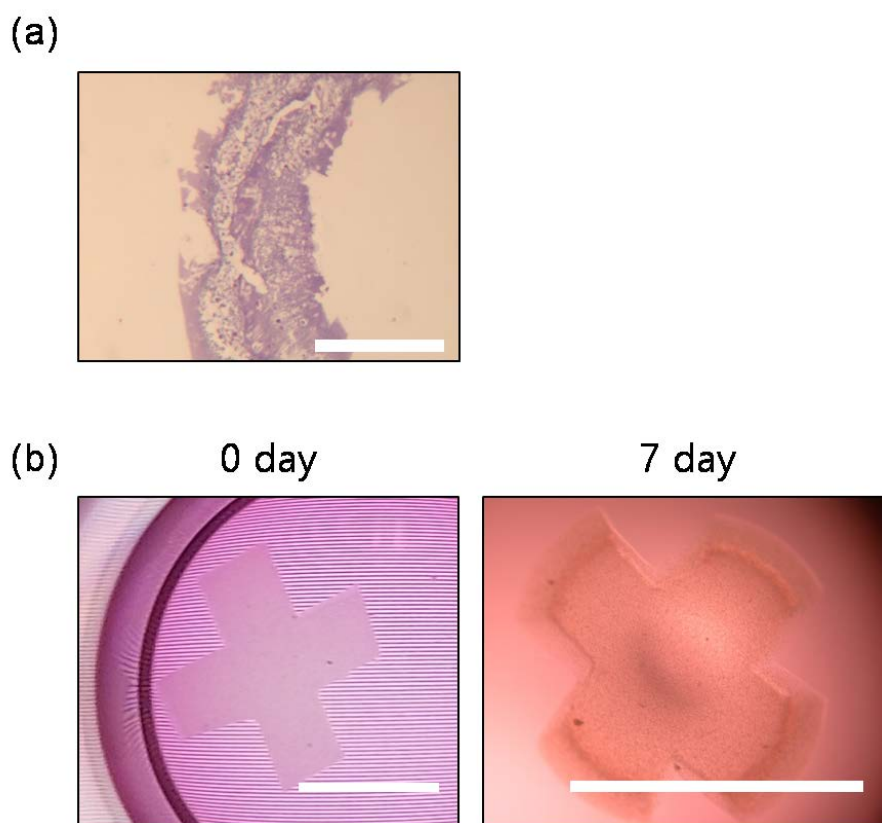
**Figure. S2.** (a) Photographs of 4D construct shape change over time with 8%OMA15 macromer concentration. (b) Optical images of 4D constructs showing effects of 0.8 mm construct thickness on 4D geometric change. The diameter of the wells in the images is 15.6 mm.



**Figure. S3.** (a) Phase contrast images of the 4D high density NIH3T3 constructs with varied cell densities from the side view at 0 days of culture. Scale bar indicates 1 mm. (b) Top view images obtained using a stereomicroscope of 4D high density NIH3T3 constructs with different OMA layer thicknesses after 21 days of culture. Scale bar indicates 5 mm.



**Figure. S4.** Live/dead stained photomicrographs obtained after 1 and 21 days culture of 4D ASC high cell density constructs cultured in growth, chondrogenic and osteogenic media. Scale bar indicates 200  $\mu\text{m}$ .



**Figure. S5.** (a) Photomicrograph of a H&E stained histologic section of an NIH3T3-laden 4D high density construct (12%OMA15\_0.4 mm/12%GelMA\_0.2 mm, NIH3T3 at density of  $1.0 \times 10^8$  cells/ml in both layers). Scale bar indicates 500  $\mu$ m. (b) Images of 4D high cell density construct exhibiting geometric shape change from a cross to a gripper (scale bar = 5 mm).