Supplementary Dataset

Direct 3D Bioprinting of Perfusable Vascular Constructs Using a Blend Bioink

Weitao Jia [a, b, c, †], P. Selcan Gungor-Ozkerim [a, b, †], Yu Shrike Zhang [a, b, d, †, *], Kan Yue [a, b], Kai Zhu [a, b, e], Wanjun Liu [a, b], Qingment Pi [a, b], Batzaya Byambaa [a, b], Mehmet Remzi Dokmeci [a, b, d], Su Ryon Shin [a, b, d, *], Ali Khademhosseini [a, b, d, f, g, *]

[a] Biomaterials Innovation Research Center, Division of Biomedical Engineering, Department of Medicine, Brigham and Women's Hospital, Harvard Medical School, Cambridge, MA 02139, USA.

[b] Harvard-MIT Division of Health Sciences and Technology, Massachusetts Institute of Technology, Cambridge, MA 02139, USA.

[c] Department of Orthopedic Surgery, Shanghai Jiaotong University Affiliated Sixth People's Hospital, Shanghai Jiaotong University, Shanghai 200233, P.R. China.

[d] Wyss Institute for Biologically Inspired Engineering, Harvard University, Boston, MA 02115, USA.

[e] Department of Cardiac Surgery, Zhongshan Hospital, Fudan University, Shanghai Institute of Cardiovascular Disease, Shanghai 200032, PR China.

[f] Department of Bioindustrial Technologies, College of Animal Bioscience and Technology, Konkuk University, Seoul 143-701, Republic of Korea.

[g] Department of Physics, King Abdulaziz University, Jeddah 21569, Saudi Arabia.

[†]These authors contributed equally as first author to this work.

[*] Corresponding authors: alik@bwh.harvard.edu (A.K.); shin.lotus@gmail.com (S.R.S.); yszhang@research.bwh.harvard.edu (Y.S.Z.)

Running headline: 3D Bioprinting of Perfusable Vascular Constructs

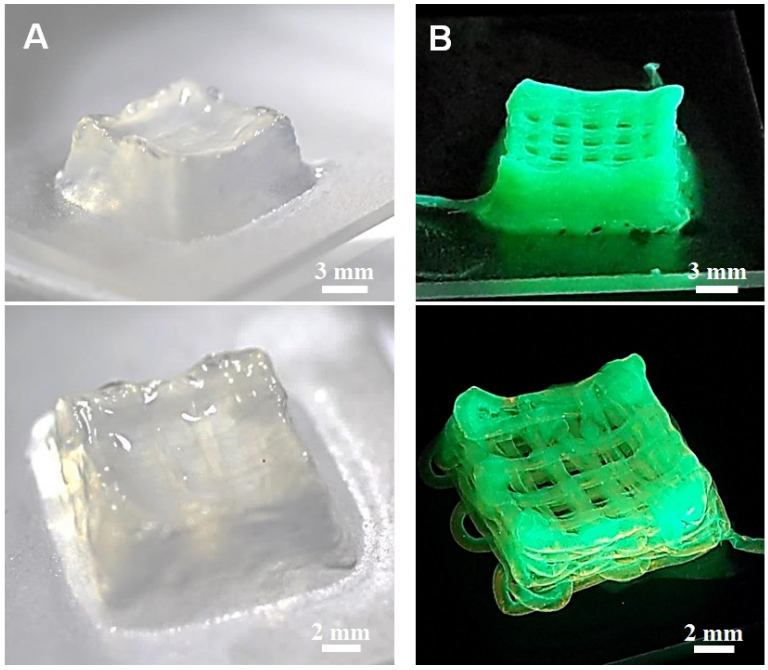

Figure S1. (A) Side and top views of a bioprinted cubic construct with 10 layers of perfusable fibers and (B) corresponding fluorescence photographs.

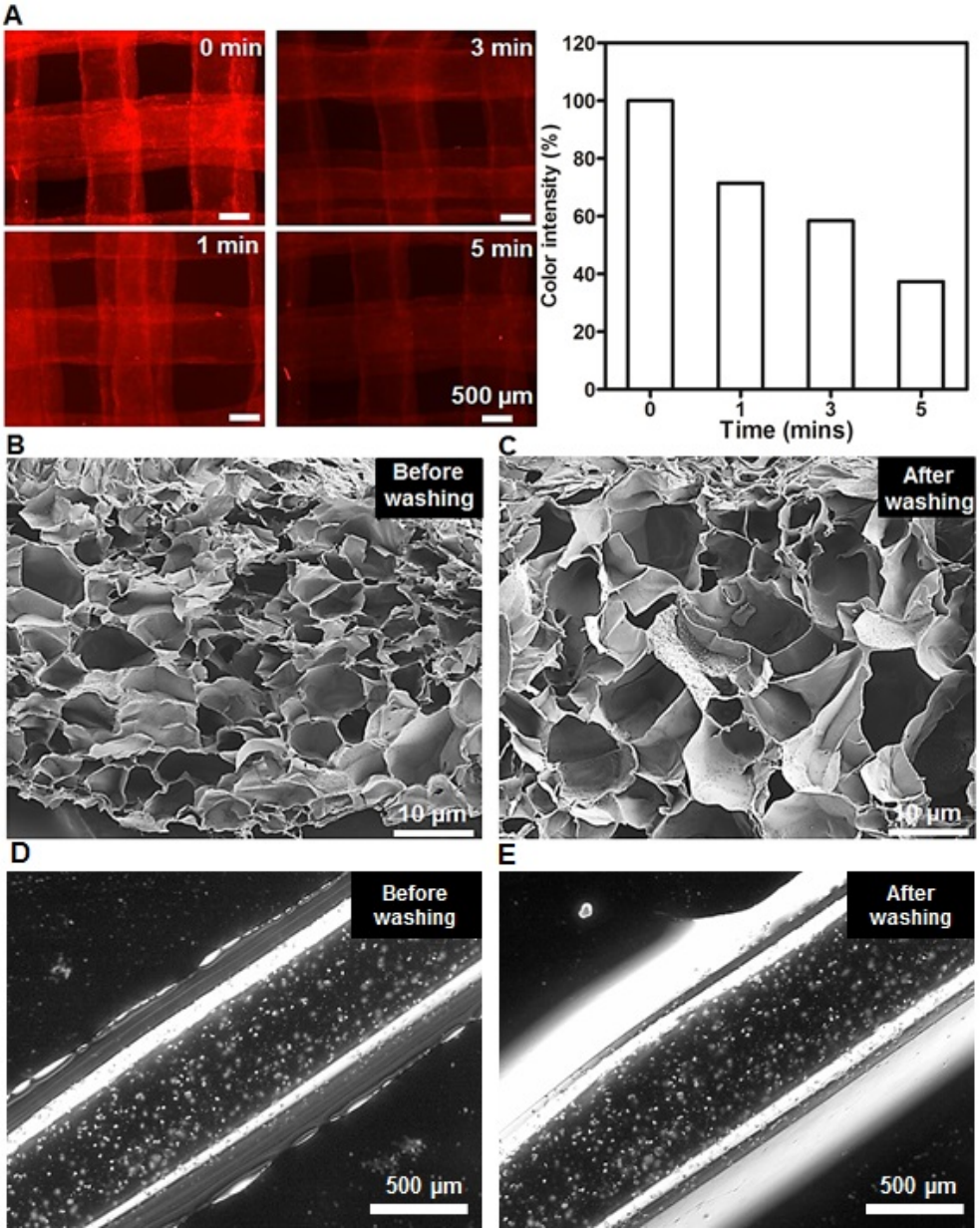

Figure S2. (A) Fluorescence micrographs and quantification of the bioprinted construct at 0, 1, 3, and 5 min after washing in EDTA, indicating that fluorescently labeled alginate was gradually removed. (B and C) SEM images showing the morphology of the wall of a perfusable fiber (B) pre- and (C) post-removal of alginate, where larger pores were observed after removal of the alginate. (C and D) Micrographs showing the retention of encapsulated vascular cells in the fiber wall post removal of the alginate.

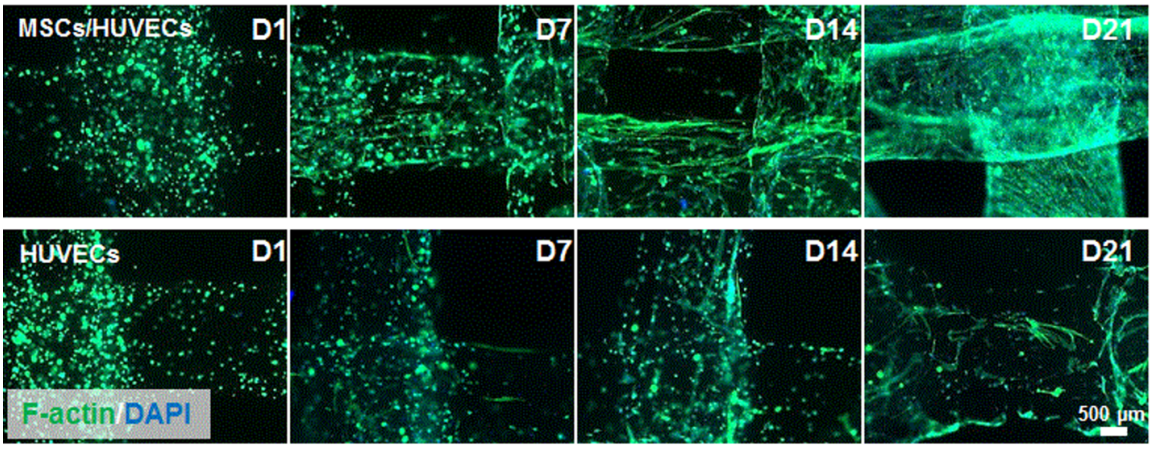

Figure S3. Fluorescence micrographs of f-actin/nuclei staining for comparasion of spreading and morphology of HUVECs alone and co-culture of HUVECs/MSCs encapsulated in the bioprinted constructs at 1, 7, 14, and 21 days of culture at 6.9 mW cm^{-2} UV light for 30 s, respectively.

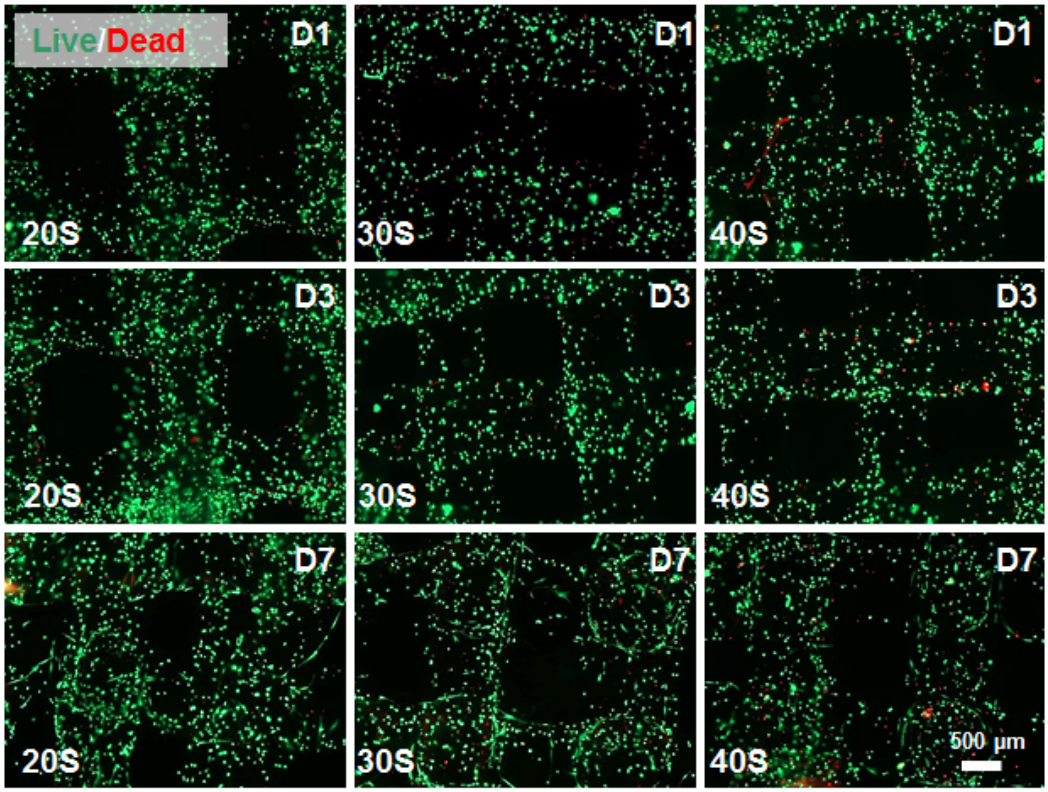

Figure S4. Fluorescence micrographs of Live/Dead staining after 1, 3, and 7 days of culture for the bioprinted perfusable constructs encapsulating vascular cells crosslinked by 6.9 mW cm^{-2} UV for 20 s, 30 s, and 40 s, respectively.

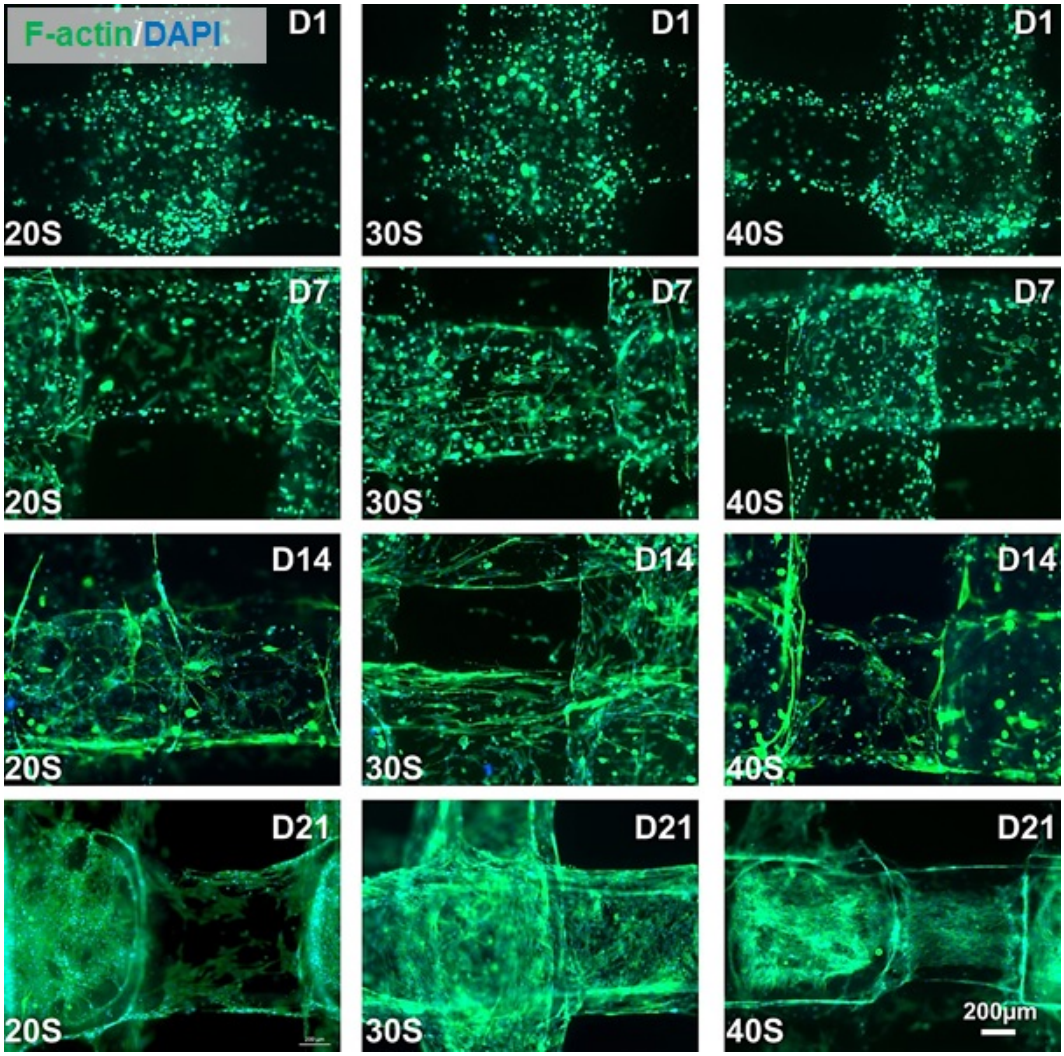

Figure S5. Fluorescence micrographs of f-actin/nuclei staining at 1, 7, 14, and 21 days of culture for the bioprinted perfusable constructs encapsulating vascular cells crosslinked by 6.9 mW cm^{-2} UV light for 20 s, 30 s, and 40 s, respectively.

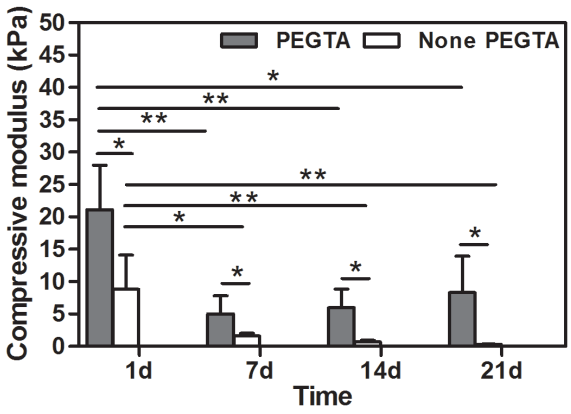

Figure S6. Comparison of compressive moduli between vascular cell-encapsulated constructs using bioink composed of 7% GelMA (w/v) and 3% alginate (w/v) mixed with 2% 4-arm PEGTA (w/v) and bioink without PEGTA, crosslinked by 6.9 mW cm^{-2} UV light for 30 s, at 1, 7, 14, and 21 days of culture (n = 6; *$p < 0.05$, **$p < 0.001$).

Supporting Movies

File Name	Description
Movie 1.mpg	Printing process of a multilayered hollow tube construct (2X replay speed).
Movie 2.mpg	Perfusion through a bioprinted grid-like construct containing 10 layers of hollow single hollow tube.