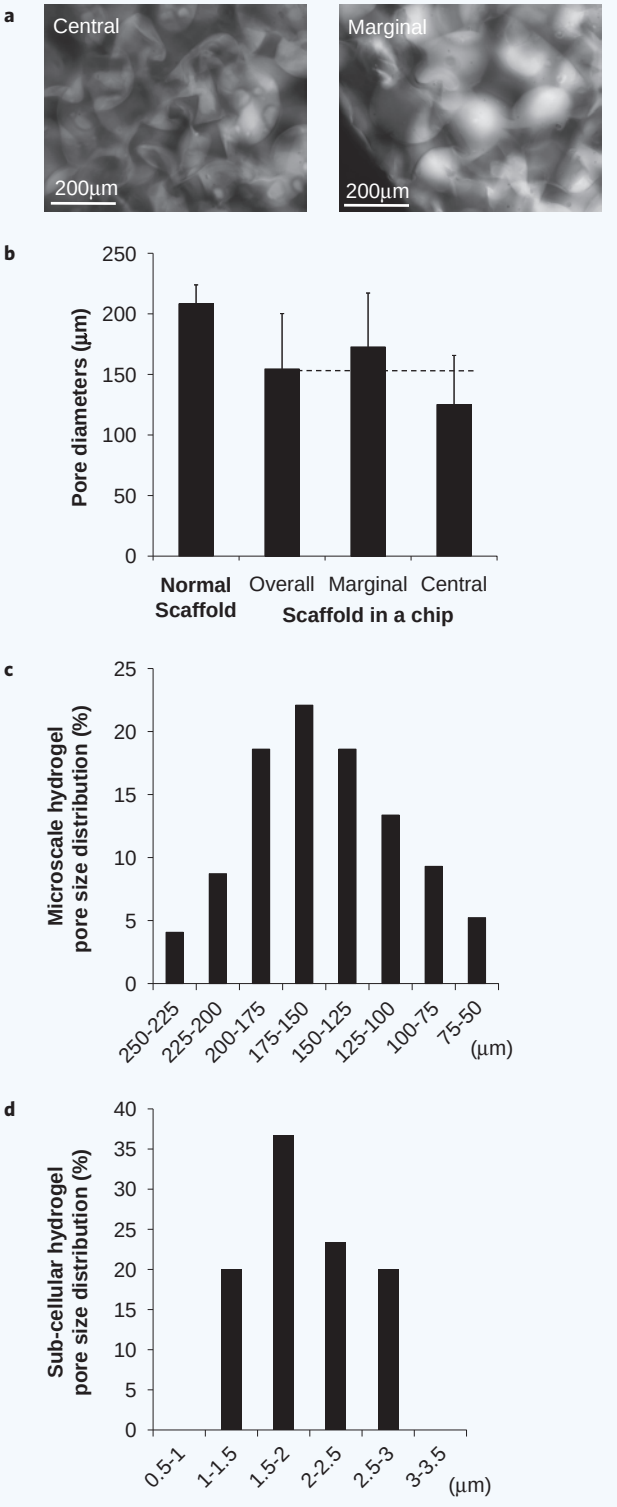
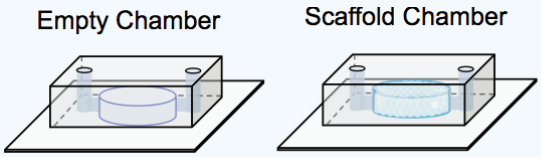
SUPPLEMENTARY INFORMATION



Supplementary Figure 1 (**a**) Fluorescent microscope images of central and marginal regions of microfluidic hydrogel scaffolds after loading FITC-Dextran. (**b**) Comparison of pore size in different regions of microfluidic hydrogel scaffolds ($n = 55$). (**c**) Histogram of microscale hydrogel pore size distribution of microfluidic scaffolds ($n = 100$). (**d**) Histogram of sub-cellular hydrogel pore size distribution ($n = 30$).



D=6mm, H=1mm
Volume= 28.28mm^3
Surface area=28.28mm^2

Assumptions
- Each pore has spherical shape
- Each pore has 12 channels

Pore D=0.154mm
Channel D=0.03mm
Each pore has 12 channels

Estimated total surface area of a scaffold-chip

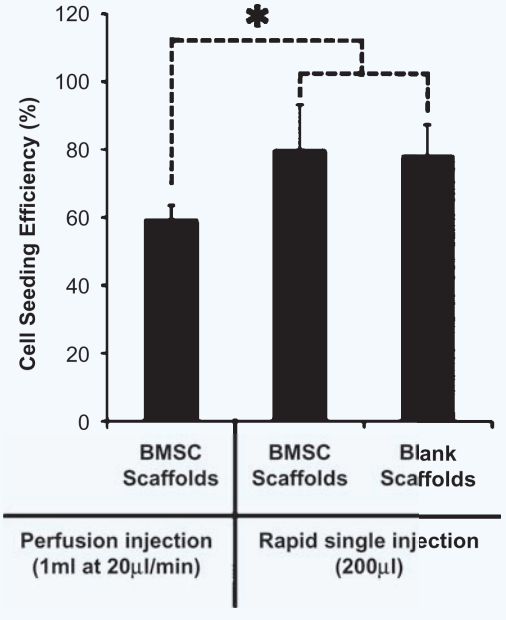
Chamber volume = Each pore volume x Total pore number
* Pore volume=0.0019123mm^3
* Total pore number= 14,778

Available pore surface = Pore surface – Channel area x (12)
* Pore surface= 0.0745mm^2
* Channel area= 0.00848mm^2
* Available pore surface= 0.06602mm^2

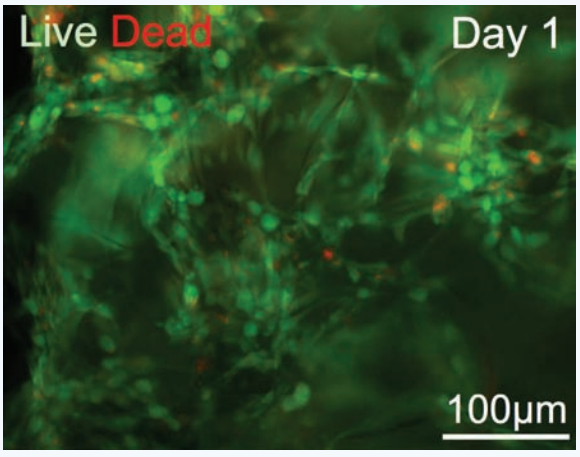
Total available pore surface
= Available pore surface x Total pore number
= 975.64mm^2

Total surface for cell adhesion
= Chamber surface + Scaffold surface
=1003.92mm^2
*** Provide about 35 more surface area than an empty chamber**

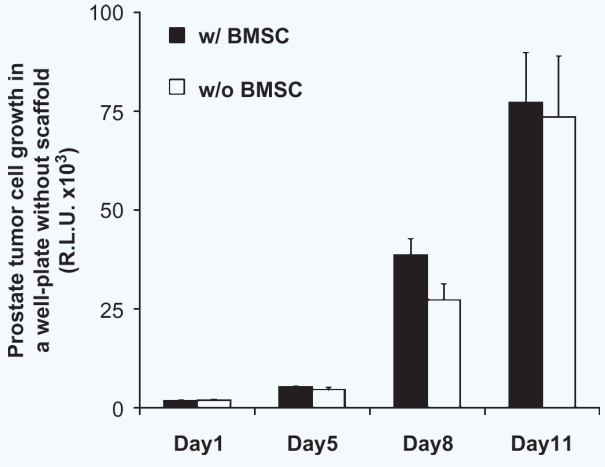
Supplementary Figure 2 Assumptions and calculation of total surface area for cell adhesion in a microfluidic hydrogel scaffold in comparison with an empty chamber.



Supplementary Figure 3 Comparison of cell seeding efficiency depending on seeding methods and pre-coated BMSCs (n = 5, $^*p < 0.05$).



Supplementary Figure 4 Fluorescent image of live-dead staining after 24 hours perfusion culture of human BMSCs in a microfluidic hydrogel scaffold (Green: live, Red: dead). Fluorescent image based analysis indicated 90 ± 2% cell viability (N = 3).



Supplementary Figure 5 Comparison of human prostate tumor growth on 2D culture with and without human BMSCs. The result showed growth of PC3 tumor cells is independent of human BMSCs on a 2D substrate (n = 5).