Supporting Information

Hydrogel microfibers with perfusable folded channels for tissue constructs with folded morphology

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1. Discussions

1.1 Calculations in permeation test

Calculation process of Figure 6b is presented as followed. The slope of red fluorescence intensity in area 4 is in Equation 1, and the slope of green fluorescence intensity in area 4 is in Equation 2.

$$k_{R4} = (1 - 0.7203) \div 300 = 9.32 \times 10^{-4} \quad (1)$$

$$k_{G4} = (0.8611 - 0.3070) \div 210 = 2.64 \times 10^{-3} \quad (2)$$

The ratio between k_{G4} and k_{R4} is 2.83. In addition, Calculation process of Figure 6c is also presented. In Figure 6c, the intensity demonstrates inverted U curve, i.e. upward first and then downward, with pixel numbers increasing. Using linear fit method, upward and downward parts of three green lines are fitted and the slope is in Table S1. It is indicated that the slope range of downward parts is greater than upper ones. Asymmetric concentration gradient is built between two sides of the folded channel.

Table S1. Linear fitted three green lines

Name	G1-up	G2-up	G3-up	G1-down	G2-down	G3-down
Slope	0.0019	0.0019	0.0017	-0.0038	-0.0035	-0.0014
R^2	0.9828	0.9899	0.9876	0.9252	0.9879	0.9879

1.2 Microfibers with three channels

Moreover, three channel microfibers are explored additionally. The morphologies are more complicated, but still in order. If three inner inlets in microfluidic devices are positioned in a line, the channel morphology is three-folded, i.e. three channels are folded parallel. However, if three inlets are positioned as a triangle, most cases are three-coiled, i.e. coiled synchronously (Figure S1).

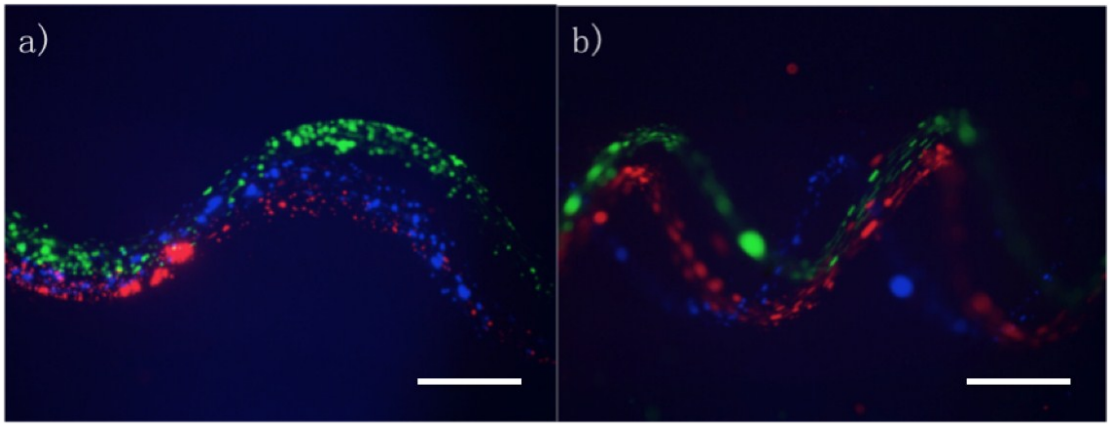

Figure S1. Fabrication of microfibers with three-inner channels. A) Three inner tubes in microfluidic device are paralleled in a line. The hollow channels in microfiber are sine-wave in a plain. B) Three inner channels in microfluidic device are positioned in a triangle. The hollow channels in microfiber are spiral parallelly. The scale bar is 500 μm.

1.3 Weavability of microfibers with straight-folded channels

Furthermore, the ability to weave has also been explored (Figure S2). Two kinds of basic knot are fabricated using sfFiber. It is indicated that the strength of fiber could be used to weave for tissue engineering.

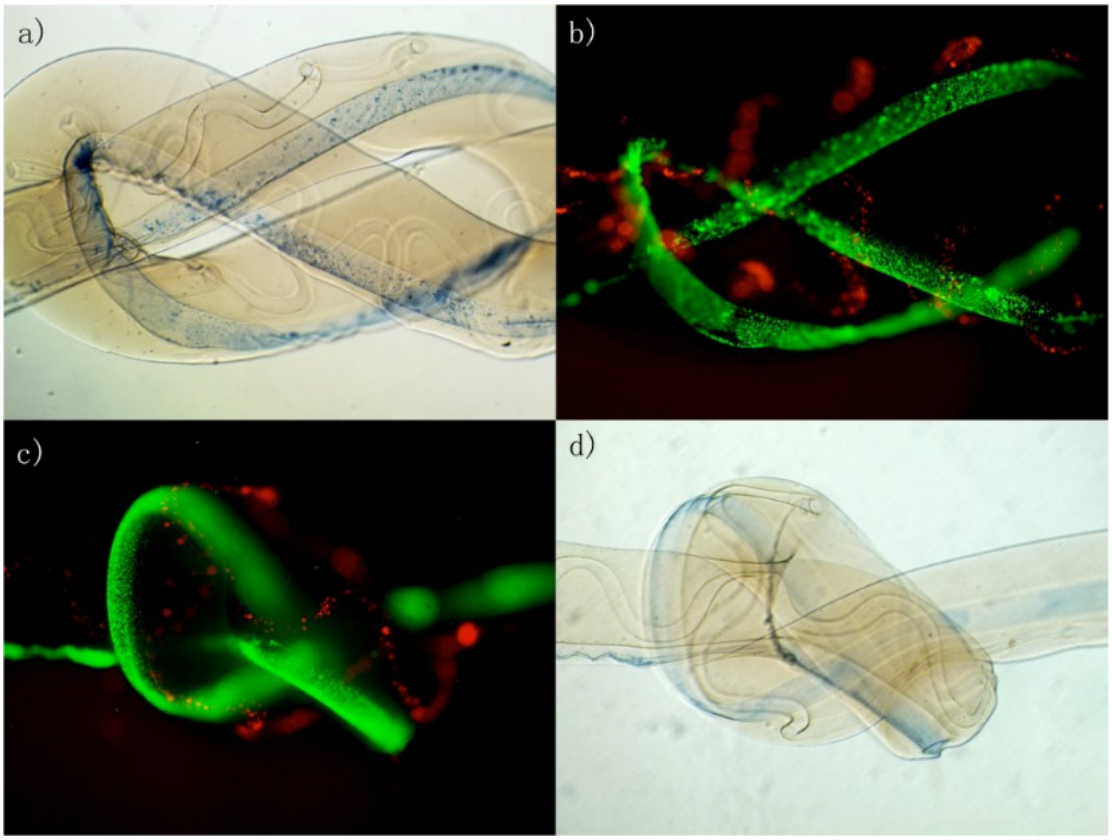

Figure S2. Knots using sf-Fibers characterized under bright field and fluorescence field. a-b) Figure-eight knot, c-d) Overhand knot.

2. Supplementary Videos

2.1 Video S1 Microfiber generation

2.2 Video S2 Fiber With Three Channels

2.3 Video S3 Perfusability of Microfibers With three channels

2.4 Video S4 Skeletal Muscle Constructs

2.5 Video S5 Perfusion Experiment