

Electronic Supplementary Information

Porous polymer microneedles with interconnecting microchannels for rapid biological fluid transport

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Monomer stock solution			Porogen stock solution		Photoinitiator	Porogen ratio [%]
GMA [mL]	TRIM [mL]	TEGDMA [mL]	PEG [g]	2-methoxyethanol [mL]	Irgacure 184 [g]	
10	5.23	15.7	0	0	0.1	0
10	5.23	15.7	2.0	10.0	0.1	24
10	5.23	15.7	2.5	12.5	0.1	29
10	5.23	15.7	3.0	15.0	0.1	33
10	5.23	15.7	3.5	17.5	0.1	36
10	5.23	15.7	4.0	20.0	0.1	39
10	5.23	15.7	6.0	30.0	0.1	49
10	5.23	15.7	8.0	40.0	0.1	56
10	5.23	15.7	10	50.0	0.1	62
10	5.23	15.7	20	100	0.1	76

Table S1. Mixtures of two stock solutions for varied porogen ratios. Porogen ratio is defined as the volume ratio of a porogen stock solution to the whole mixture. It is assumed that (1) the volume of a PEG solution in 2-methoxyethanol is equal to that of the original solvent, and (2) the volume of the monomer stock solution is the sum of the volume of GMA, TRIM, and TEGDMA.

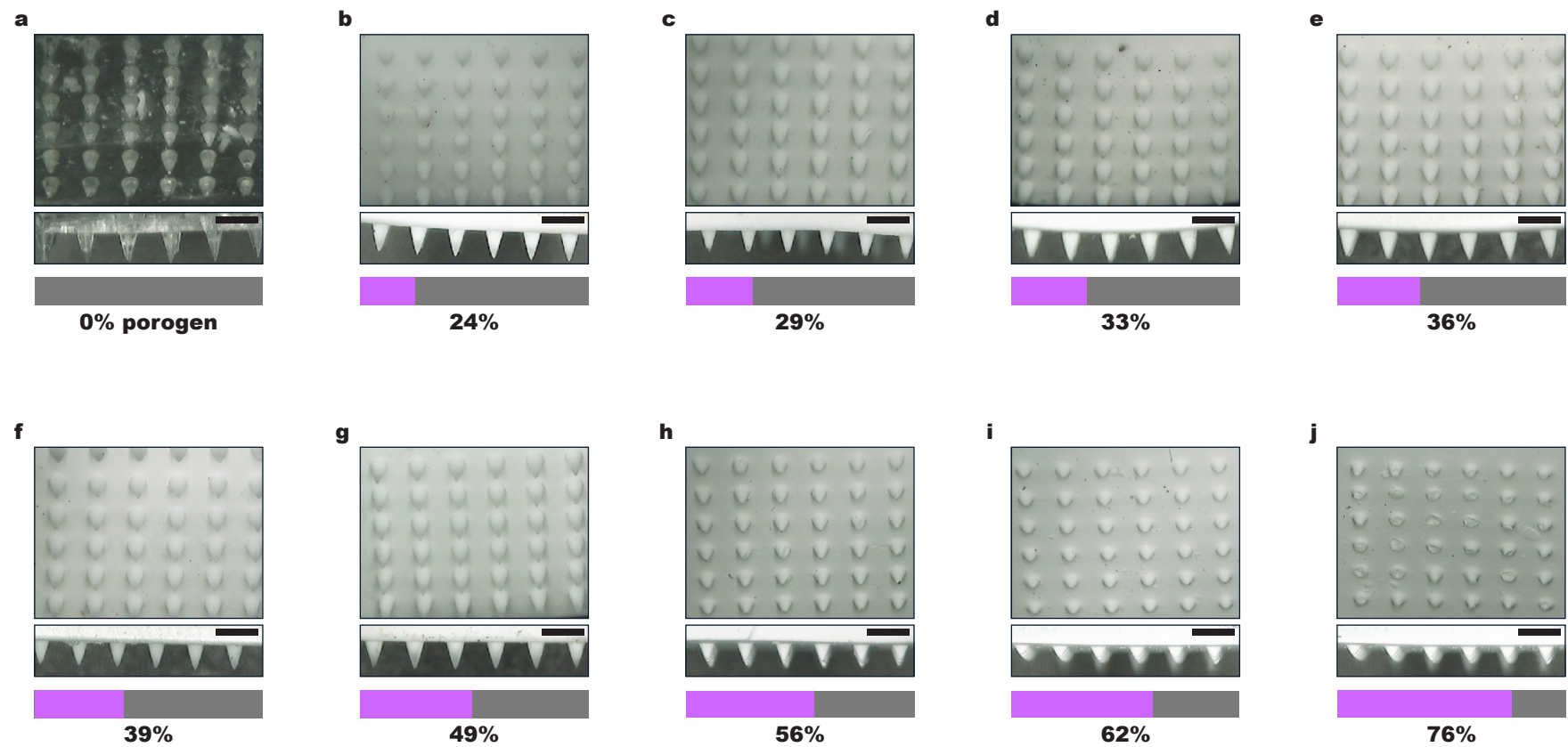
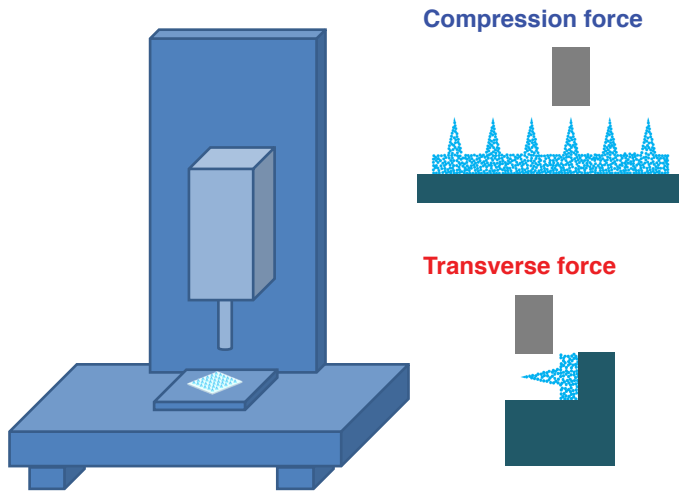
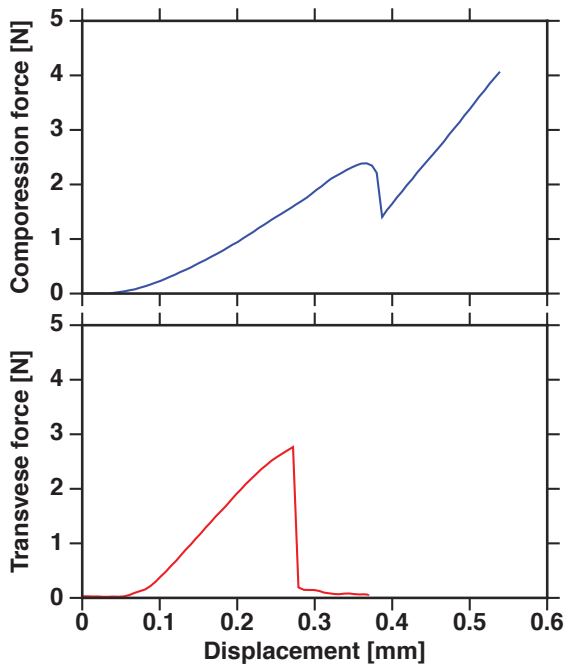


Figure S1. Optical microscopy of the microneedle arrays with different porogen ratios. (a) 0%, (b) 24%, (c) 29%, (d) 33%, (e) 36%, (f) 39%, (g) 49%, (h) 56%, (i) 62%, (j) 76%. Images were taken from 45° perspective (top row) and the side (bottom row). Scale bar: 1 mm.

a



b



c

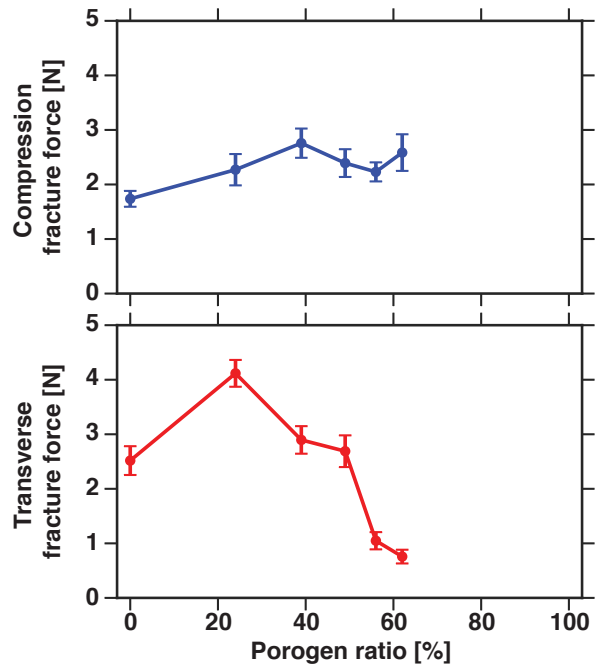


Figure S2. Mechanical strength of porous microneedles. (a) Schematic illustration of the setup for measuring mechanical fracture forces. (b) Representative profiles of force vs. displacement during fracture testing. Compression force (top; blue curve) and transverse force (bottom; red curve). (c) Fracture strengths for compression force (top; blue lines) and transverse force (bottom; red lines).

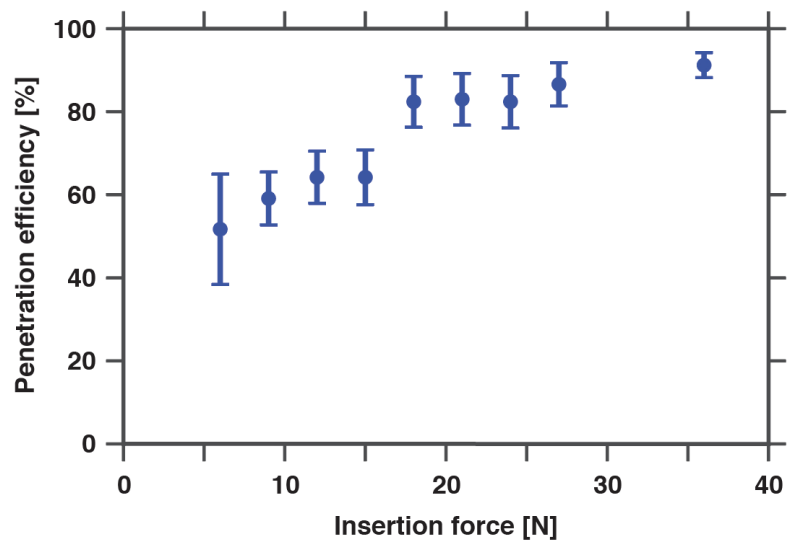


Figure S3. Skin penetration efficiency of the microneedles with 0% porogen ratio for different insertion forces. Eight samples of microneedle arrays (each 6×6) were tested for each porogen ratio. Error bars indicate standard error of mean.

Supplementary Video. Wetting of the porous microneedle array of 56% porogen ratio that was inserted into an agarose gel containing water-based blue ink.