SUPPLEMENTAL MATERIALS for:
A vacuum manifold for rapid world-to-chip connectivity of complex PDMS microdevices
Gregory A. Cooksey, Anne L. Plant and Javier Atencia

Video S1. Real-time video showing loading of a 51-inlet PDMS microdevice onto a PMMA manifold. Dyes were injected into the device with 3.5 kPa – 7 kPa (0.5 psi – 1.0 psi) and valves were opened by applying negative pressure to the pneumatic lines, which allowed the dyes to enter into the device. Vacuum applied to the pneumatic lines (and, to some degree, the vacuum applied through the manifold) helped to remove air bubbles trapped in the device during loading. In addition to the 2 min needed to begin loading the dyes as shown in the movie, an additional 20 min of pressurization and selective valve actuation was necessary to drive bubbles out of all channels and fill all inlets into the chip. Movie duration is 2 min 17 s.

Video S2. Video showing perspective views rotated from the top to the front side of a 51-inlet device loaded on a manifold to the side. The device was loaded with dyes and operating at 7 kPa (1 psi) fluid pressure.

Table S1. Leakage pressures for different PDMS and PMMA manifold configurations. Columns A, B, and C under indicate measurements from 3 identically milled test devices. Each measurement for 0.75 mm PDMS hole represents the average of 2 independent tests (except *). See plot of mean leakage pressure in Fig. S2.

PDMS hole size (mm)	Seal width (mm)	Leakage Pressure kPa (psi) A	B	C	Mean kPa (psi)	Stdev kPa (psi)
0.5	0.64	159 (23.0)	110 (16.0)	12.1 (17.5)	130 (18.8)	25.5 (3.7)
0.5	1.03	62.0 (9.0)	42.1 (6.1)	128 (18.5)	77.2 (11.2)	44.8 (6.5)
0.5	1.44	147 (21.3)	57.2 (8.3)	86.1 (12.5)	93.8 (13.6)	37.9 (5.5)
0.5	1.87	131 (19.0)	66.9 (9.7)	98.6 (14.3)	98.6 (14.3)	32.4 (4.7)
0.75	0.64	96.5 (14.0)	91.0 (13.2)	115 (16.7)	101 (14.6)	19.3 (2.8)
0.75	1.03	88.9 (12.9)	117 (17.0)	81.4 (11.8)	95.8 (13.9)	21.3 (3.1)
0.75	1.44	106 (15.4)	117 (16.9)	99.3 (14.4)	107 (15.5)	11.7 (1.7)
0.75	1.87	90.3 (13.1)	114 (16.6)	115 (16.7)*	105 (15.2)	10.3 (1.5)
				(n = 23) Overall	**101 (14.7)**	**28.3 (4.1)**

*** Only 1 measurement**

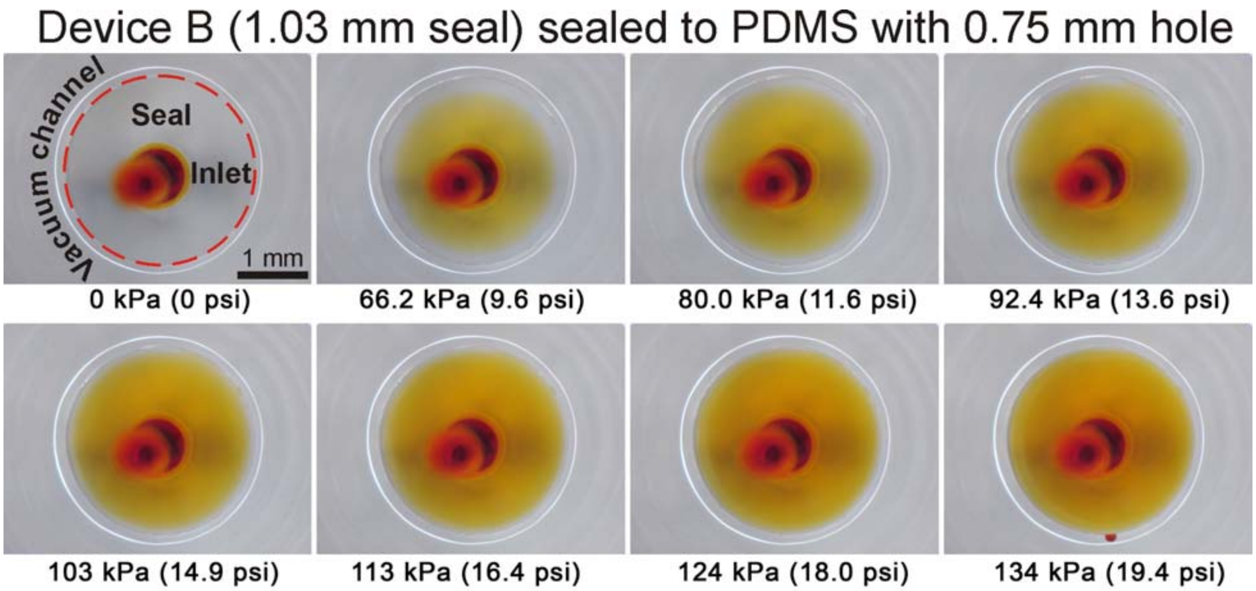

Figure S1. Increasing fluid pressure causes delamination of PDMS from PMMA manifold and eventual leakage of the seal between the inlet port and the vacuum annulus. Images show extent of delamination as fluid pressure increased from top left (completely sealed – red dye filling punched PDMS access port) to bottom right (dye has forced through the seal and leaked into the vacuum annulus). The images are shown after 2 min equilibration at each pressure. The extent of delamination was stable – several tests confirmed that the ring of delamination did not expand after holding constant pressure on the inlet for more than 2 h. Subsequent tests conducted after failing showed that devices performed similarly for multiple fail and reseal events. With thinner, glass-backed PDMS layers, we did not see gradual delamination as shown above, but rather an all-at-once failure, which supports our hypothesis that a rigid backing redistributes the stresses within the PDMS to allow stronger holding forces.

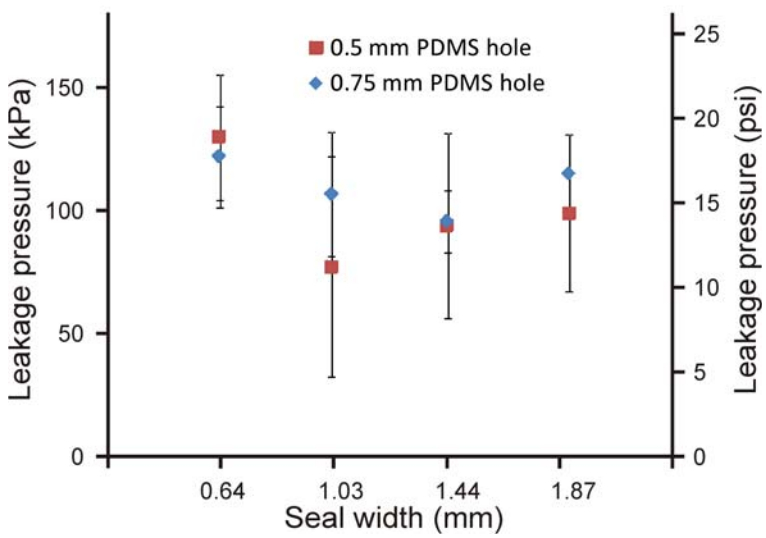

Figure S2. Average leakage pressures (± standard deviation of at least 3 measurements) of PDMS with either 0.5 mm or 0.75 mm punched inlet holes held by vacuum against PMMA manifolds with different seal widths. PDMS devices were ≈ 3 mm thick and bonded to glass slides. The PMMA manifold inlet holes were ≈ 0.8 mm diameter, and vacuum annuli were 1.35 mm wide. Raw data are shown in Table S1.