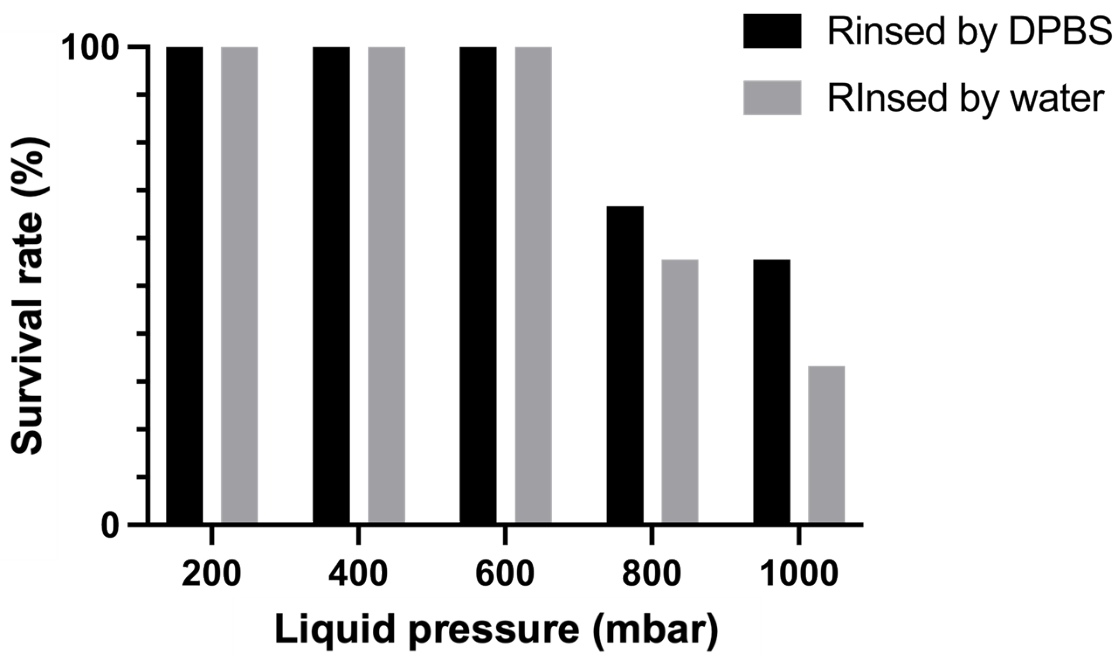

Fig. S1 Burst pressure results comparison of devices with the water-rinsed or DPBS-rinsed PS substrate (n = 9).

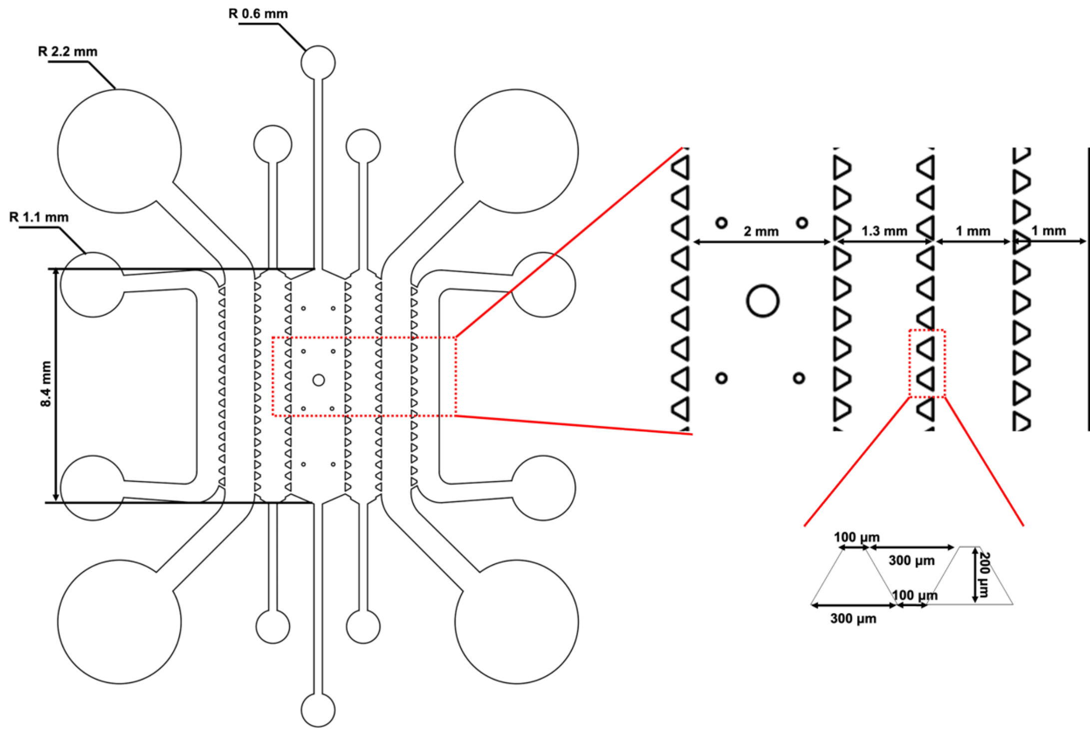

Fig. S2 The diagram provides an intricate view of the microfluidic device, which is constructed with seven distinct channels. These channels are segregated by microposts, ensuring that various cultures remain isolated and that gels do not leak to adjacent channels while allowing the medium to flow through. Channel height: 120 - 150µm. Design is adapted from the work of Kamm and others (Chen, Whisler et al. 2017).

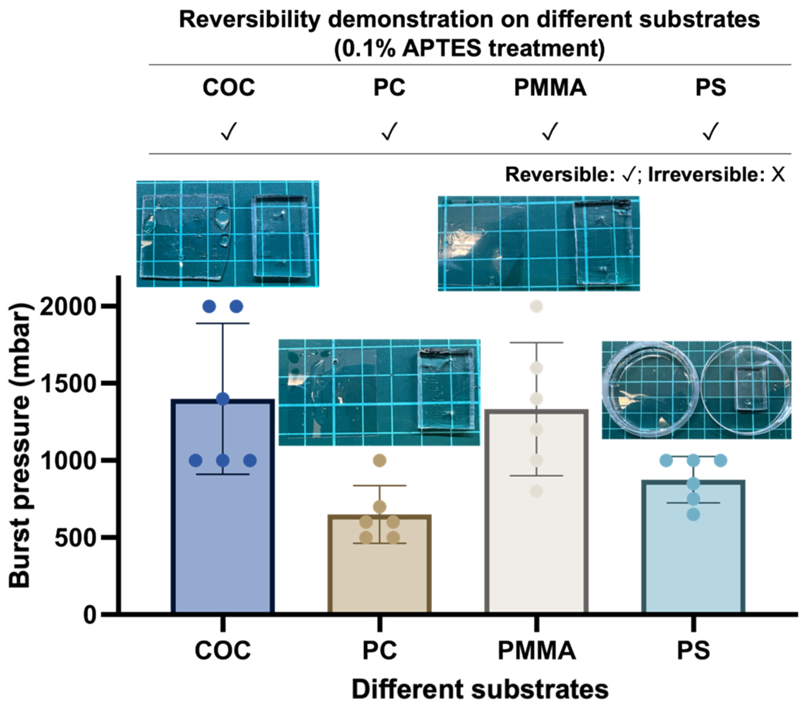

Fig. S3 Reversibility demonstration by burst pressure test on different thermoplastics: cyclic olefin copolymer (COC), polycarbonates (PC), poly(methyl methacrylate) (PMMA), and polystyrene (PS). Different APTES-treated substrates all showed reversibility with no obvious deformation after PDMS detaching (n = 6).

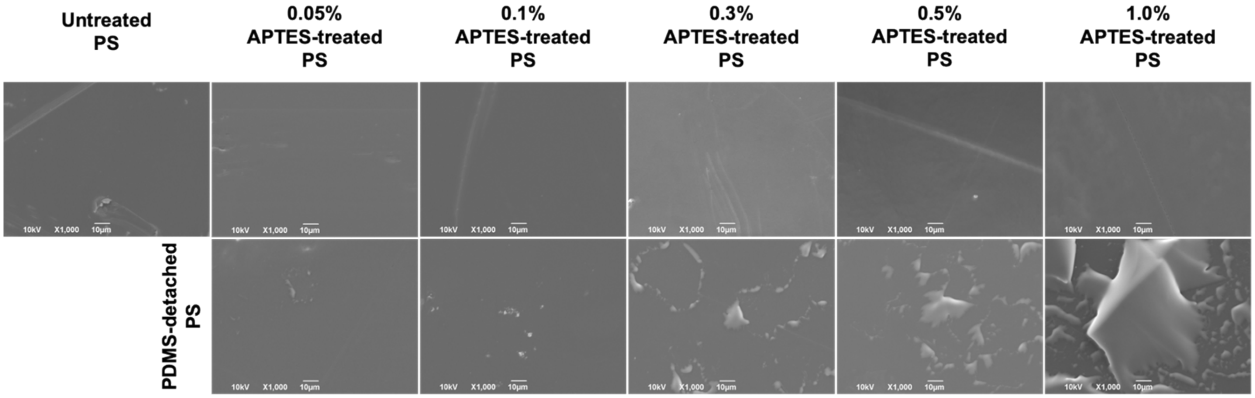

Fig. S4 SEM images of PS surface after treatment with different APTES concentrations (top); and after PDMS detachment (bottom).

As depicted in the SEM images, the surfaces of the APTES-treated PS are smooth at all concentrations. However, after PDMS bonding and subsequent peeling, the surface of the PS exhibited some PDMS fragments. The amount of PDMS residue on the PS surfaces increases with the APTES concentration. This suggests a positive correlation between the number of chemical bonds and the APTES concentration.

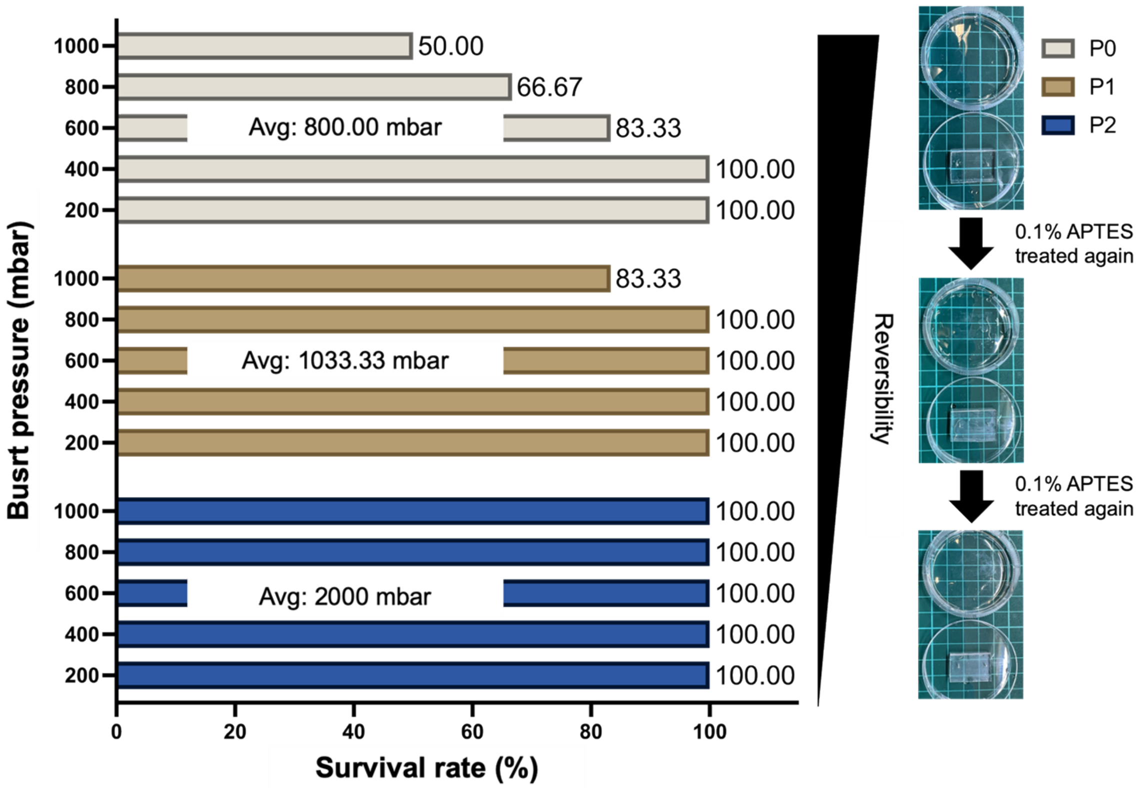

Fig. S5 Reversibility demonstration after repetitive bond-detach events (n = 6). P0: devices with one bond-detach event. P1: devices with two bond-detach events. P2: devices with three bond-detach events.

After each detachment, the substrates were re-treated with APTES and dried again. The PDMS and the re-treated substrate were quickly bonded together following plasma treatment. With the number of bonding and detachment increases, the burst pressure resistance of the devices also rises. This indicates the increase in the number of chemical bonds that causes less reversibility of the device. After three times APTES-treatment and bonding, the average burst resistance of the device reaches 2000 mbar, which would be readily regarded as an irreversible device.

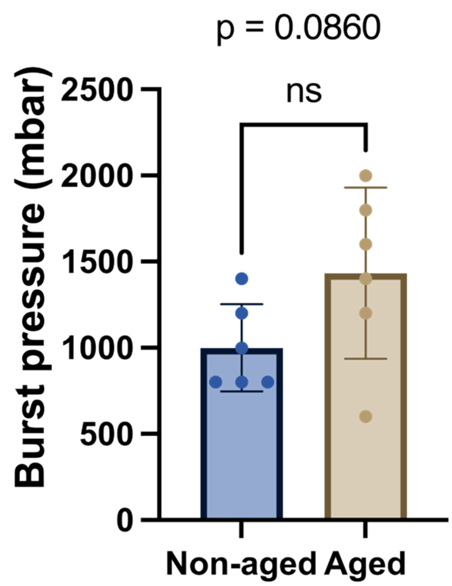

Fig. S6 Burst pressure test comparing devices with aged and non-aged PDMS. The burst resistance observed in the non-aged group was slightly lower compared to the aged group, although the difference was not statistically significant (n = 6, $p > 0.05$).

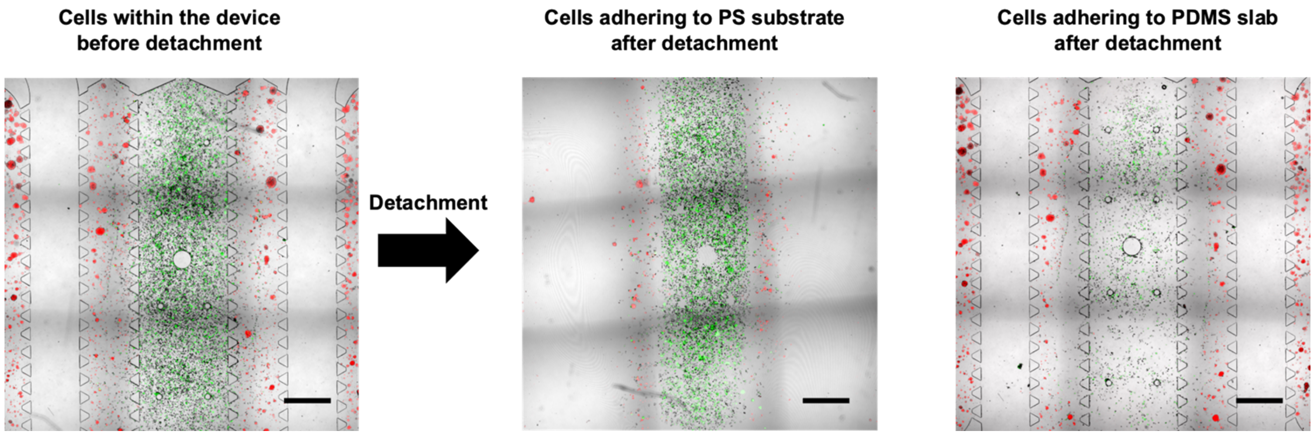

Fig. S7 Separate images of PDMS slab and PS substrate after manually peeling off (bar = 1mm). After detachment, we observe that the majority of 3D cultured cells (embedded; red) remain in the PDMS slab, and the majority of 2D cultured cells (green) remain attached to the bottom PS substrate, as expected. While for each scenario there are residual cells, the overall retrieval rate for both culturing scenarios exceeds 70%.

Table. S1 Burst pressure results of 9 reversible devices and irreversible devices

Gas pressure (mbar)		Liquid pressure (mbar)	
Reversible devices	Irreversible devices	Reversible devices	Irreversible devices
1000	1000	1000	1000
1000	1000	1000	1000
1000	1000	750	1000
1000	1000	650	1000
1000	1000	1000	1000
1000	1000	850	1000
1000	1000	600	1000
1000	1000	1000	1000
1000	1000	1000	1000

1. Chen, M. B., J. A. Whisler, J. Fröse, C. Yu, Y. Shin and R. D. Kamm (2017). "On-chip human microvasculature assay for visualization and quantification of tumor cell extravasation dynamics." Nat Protoc **12**(5): 865-880.