Ultra-sensitive microfluidic wearable strain sensor for intraocular pressure monitoring

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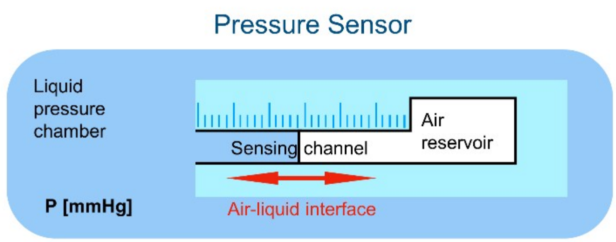
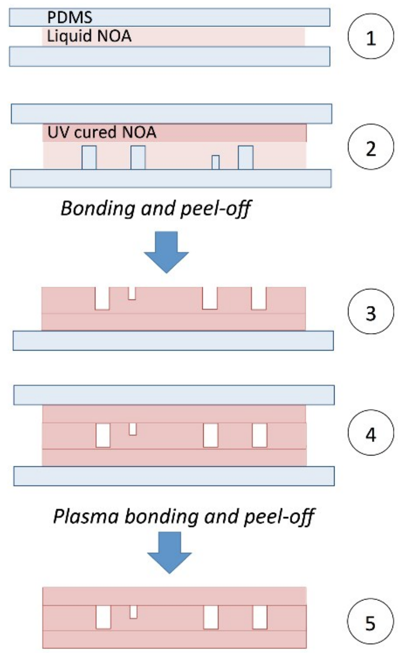
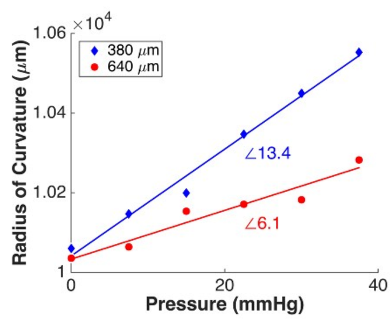
Supplementary Information



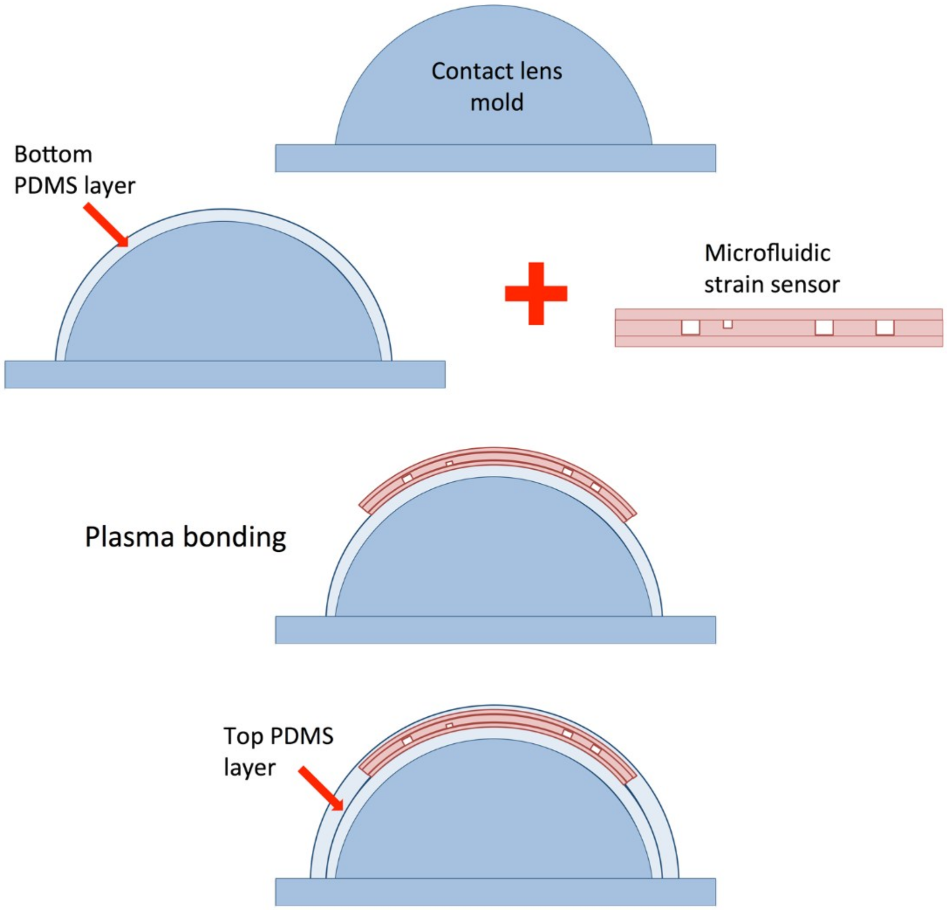
Supplementary Figure 1 *Pressure sensor operation principle based on Boyle's law. As the pressure increases (decreases) inside the liquid pressure chamber the air-liquid interface moves toward the air (liquid) reservoir in order to keep the pressure and volume product constant.*



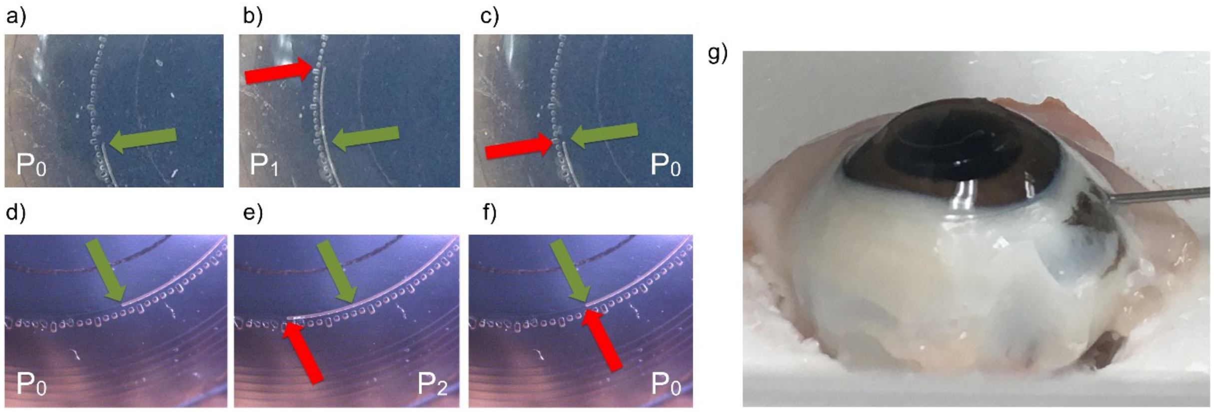
Supplementary Figure 2 *Fabrication protocol of the microfluidic strain sensor. 1) Liquid NOA65 was sandwiched between two PDMS layers and cured under UV light following the manufacturer's guidelines. 2) Liquid NOA65 was sandwiched between the PDMS mold containing the microfluidics features and a UV cured NOA65 layer. Then, it was cured under UV light. 3) After bonding was established between the two NOA65 layers, it was separated from the PDMS mold by peeling off. 4) The bonded structure was combined with another thin NOA65 layer, which was fabricated as described in step 1. Plasma-bonding techniques were applied at this stage. 5) The final sensor was peeled off the PDMS layers, ready for embedding in a contact lens.*



Supplementary Figure 3 *Hemispherical pressure vessel characterization. Blue diamonds and red circles represent data for 380 and 640 μm thick pressure vessels, respectively. The thickness of the pressure vessel was controlled using different volumes of PDMS.*



Supplementary Figure 4 *Fabrication protocol of the MSS-CL. First, a contact lens mold was covered with a thin PDMS layer in order to obtain the bottom PDMS layer of the MSS-CL. Then, the microfluidic strain sensor was bonded to this thin PDMS layer. The standard plasma-bonding techniques were applied. Finally, this combined structure was covered with a thin PDMS layer.*



Supplementary Figure 5 *a-f) Pictures of the MSS-CL on a porcine eye. a-c) The pictures taken by a smart-phone camera. d-f) The pictures taken by a stereomicroscope. P_0, P_1, and P_2 correspond to 7, 34, and 22 mmHg, respectively. g) The picture of a porcine eye experiment setup. MSS-CL was placed on the porcine eye and it was pressurized using a 16 Ga needle attached to the Elveflow OB1 pressure generator.*

Supplementary Video *The response of the sensor recorded by a smartphone camera on the hemispherical pressure vessel. The video speed is increased by 5x.*