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Supplementary Materials for

Wireless, skin-interfaced sensors for compression therapy

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The PDF file includes:

Other Supplementary Material for this manuscript includes the following:

(available at advances.sciencemag.org/cgi/content/full/6/49/eabe1655/DC1)

Movie S1. Wirelessly recorded pressure. Fractional changes of pressure by finger

Movie 2. Wirelessly monitored interface pressure using a bandage. The change in applied pressure with the number of inelastic bandages wrapping on the arm.

Fig. S1 Procedure for fabricating a 3D pressure sensor. Schematic illustration of the steps.

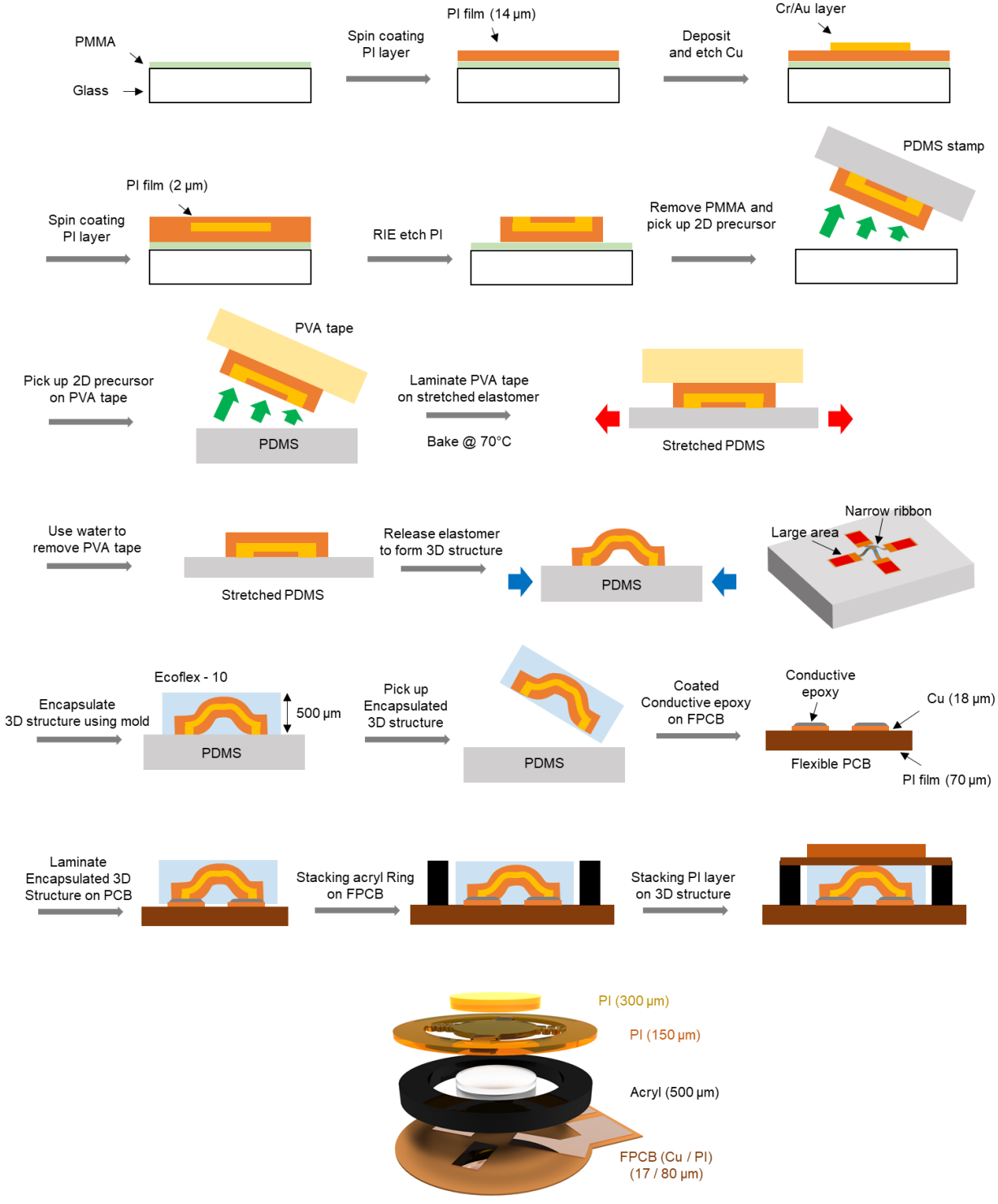

Fig. S2. The design of a 3D pressure sensor. (**A**) 2D precursor for a 3D pressure sensor. (**B**) Magnified view of four gold serpentine wires. (**C**). Layouts of polyimide, pressure sensor, acrylic ring and FPCB.

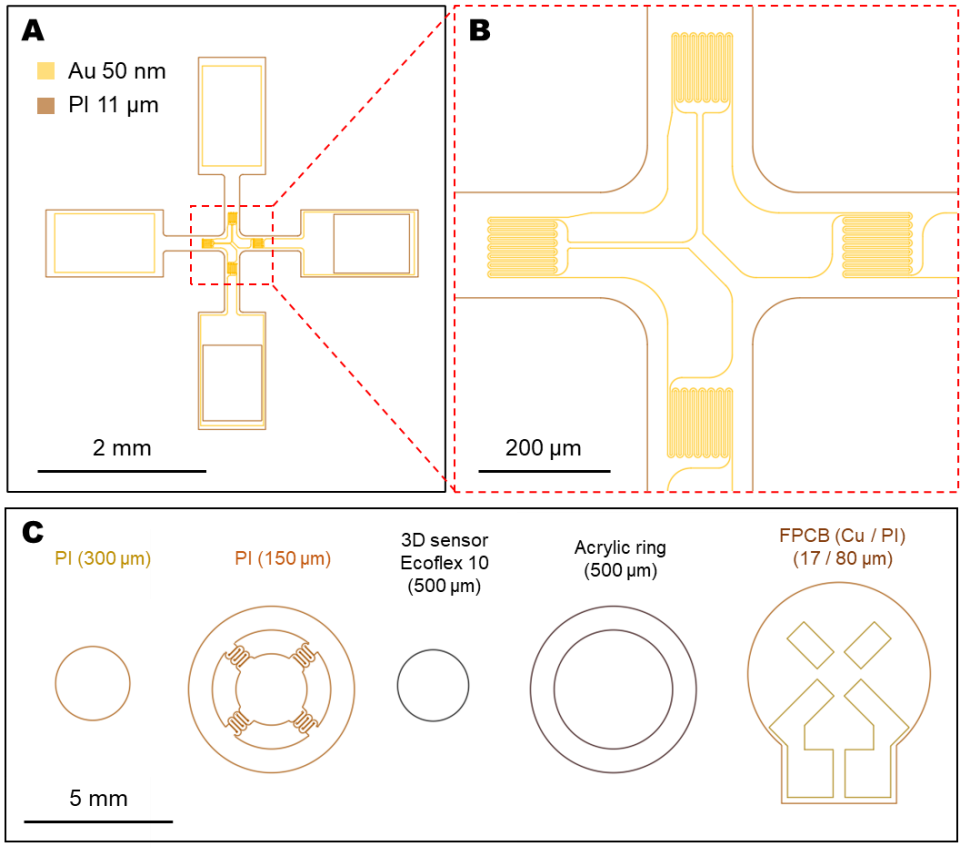

Fig. S3. Computed strains for a metal trace under compression of 0% and 12%. The maximum principal strain (ε_{max}) over the metal trace of 3D structure and 2D structure under 0% and 12% compression.

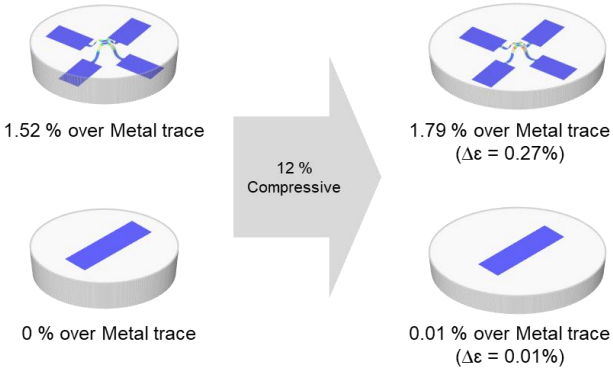

Fig. S4. Computed strains for a metal trace under compression of 0%, 12% and 24%. The maximum principal strain (ε_{max}) over the metal trace of 3D structure under 0%, 12% and 24% compression.

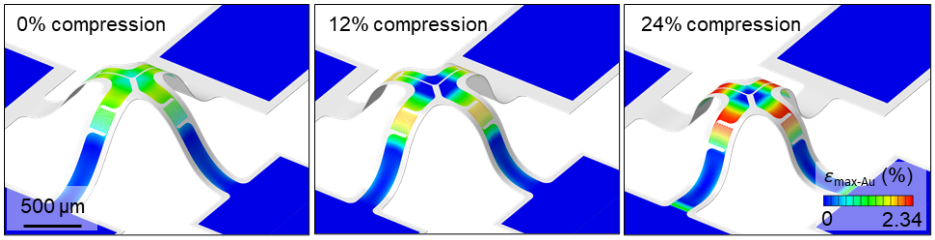

Fig. S5. Computed change in strain for a metal trace under compression of 2.5%. The change in maximum principal strain for a metal trace under compression of 2.5%.

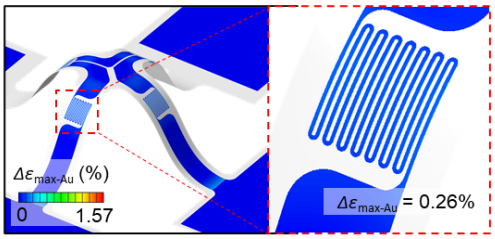

Fig. S6. Bland-Altman plots between the two paired measurements of Fig 3D. Measurement from NTC temperature sensor of SCV and IR camera

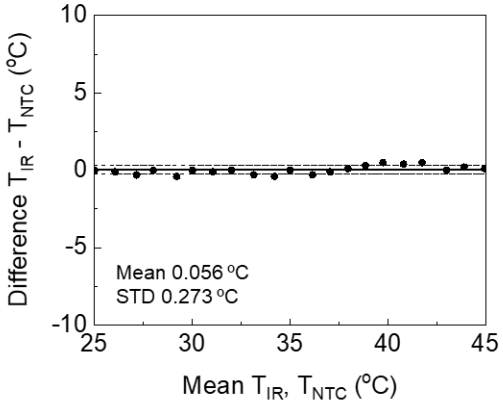

Fig. S7. Temperature dependent changes in resistance of the SCV and deformation - pressure relation of Ecoflex 10. (**A**) Change in resistance of the SCV as a function of temperature variation (room temperature 25 ºC and skin temperature 32 ºC). (B) Relation between deformation and pressure of Ecoflex 10.

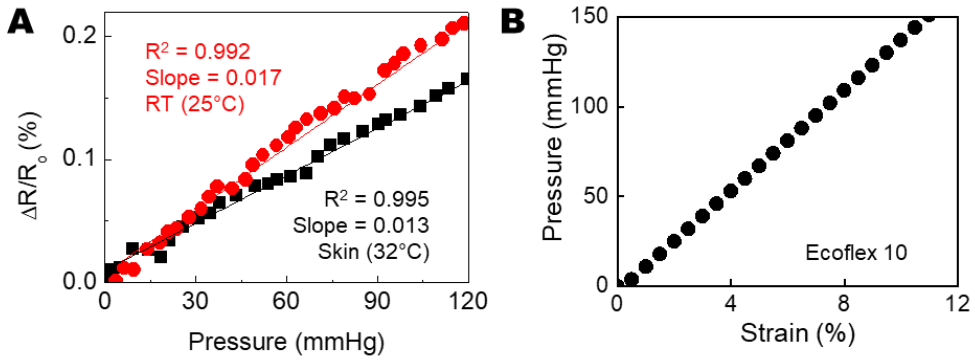

Fig. S8. Experimental set up for testing feasibility of 3D pressure sensor and reference device using universal testing machine (UTM) Optical microscopic image shows 3D sensor placing on (**A**) flat substrate, (**B**) curved substrate and (**C**) curved substrate with steel pin. Photo credit: Yoonseok Park, Northwestern University.

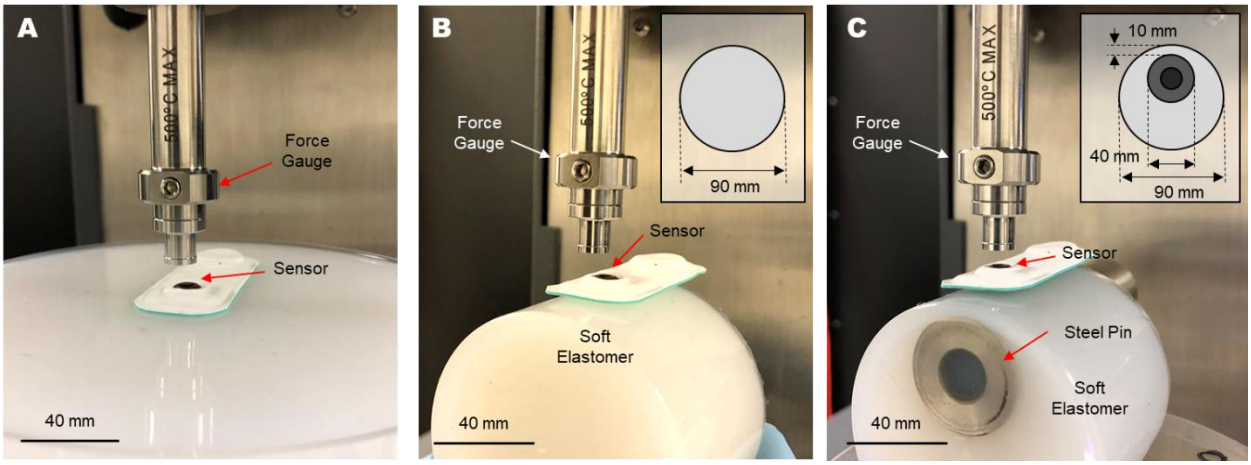

Fig. S9. Bland-Altman plots between the two paired measurements of Fig 4B. Measurement from (left) reference sensor and applied pressure from UTM and (right) 3D pressure sensor and applied pressure on flat rigid substrates.

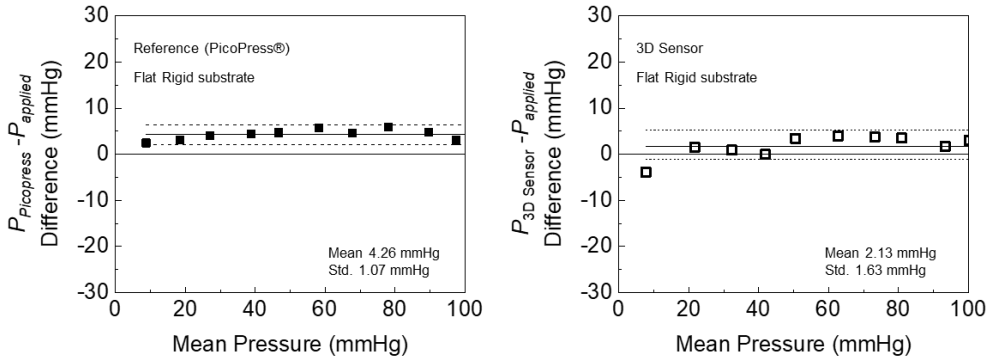

Fig. S10. Bland-Altman plots between the two paired measurements of Fig 4C. Measurement from (top) reference sensor and applied pressure from UTM and (bottom) 3D pressure sensor and applied pressure on flat substrates consist of three different elastomer (left) dragon skin 10; E = 137 kPa, (middle) Ecoflex 00-50; E = 83 kPa, (right) Ecoflex 00-30; E = 69 kPa.

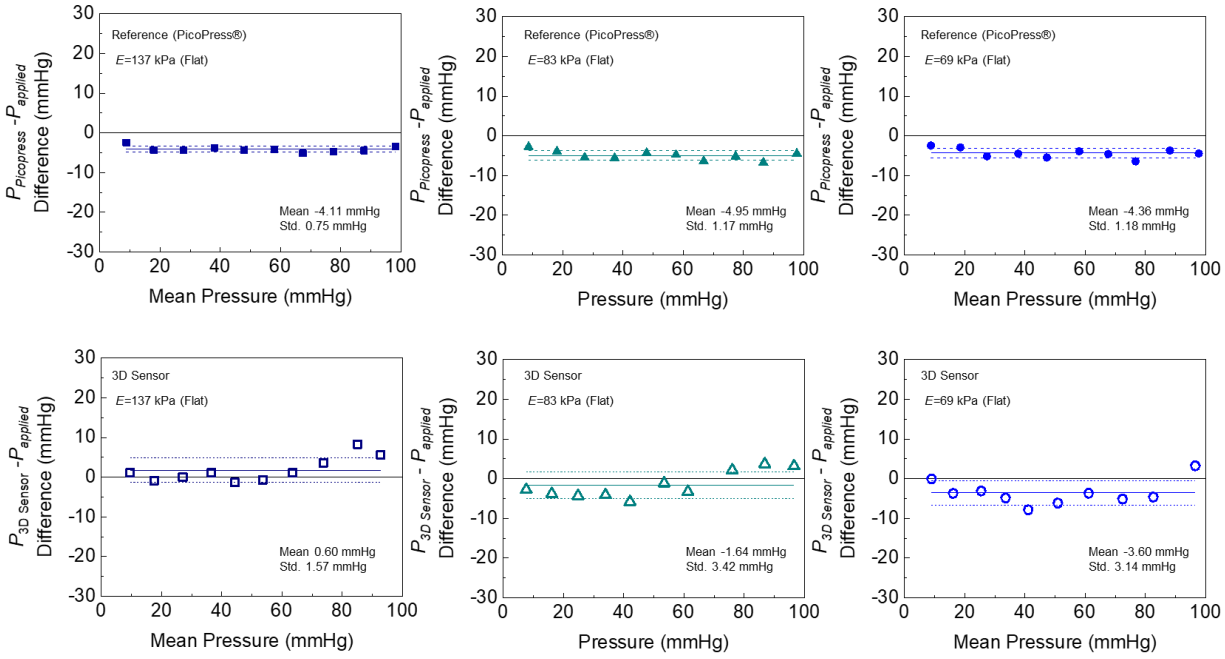

Fig. S11. Bland-Altman plots between the two paired measurements of Fig 4D. Measurement from (top) reference sensor and applied pressure from UTM and (bottom) 3D pressure sensor and applied pressure on curved substrates consist of three different elastomer (left) dragon skin 10; *E* = 137 kPa, (middle) Ecoflex 00-50; *E* = 83 kPa, (right) Ecoflex 00-30; *E* = 69 kPa.

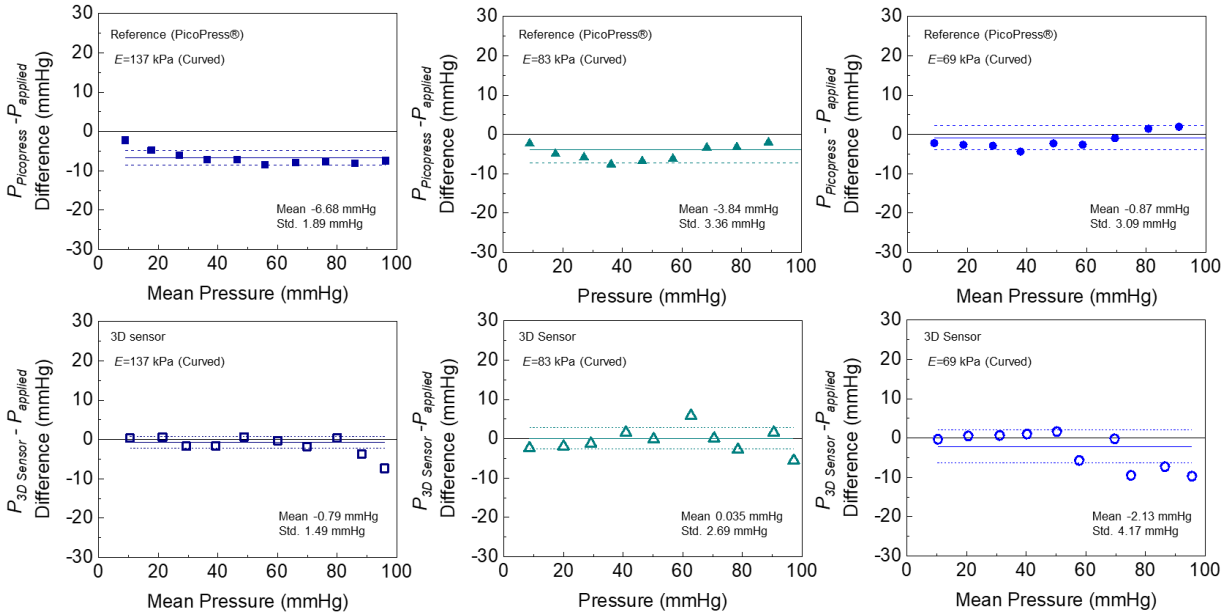

Fig. S12. Measurement of 3D sensor and reference equipment on the curved surface with metal rod inside. (**A**) Changes in resistance of 3D sensor and in pressure of reference equipment as a function of applied pressure using DMA on curved surface with metal rod inside with different materials (elastomers with different elastic modulus; dragon skin 10 (E = 137 kPa), Ecoflex 00-50 (E = 83 kPa) , Ecoflex 00-30 (E = 69 kPa)). Bland-Altman plots between the two paired measurements; (**B**) reference sensor and applied pressure from UTM and (**C**) 3D pressure sensor and applied pressure on curved substrates with metal pin consist of three different elastomer (left) dragon skin 10; E = 137 kPa, (middle) Ecoflex 00-50; E = 83 kPa, (right) Ecoflex 00-30; E = 69 kPa.

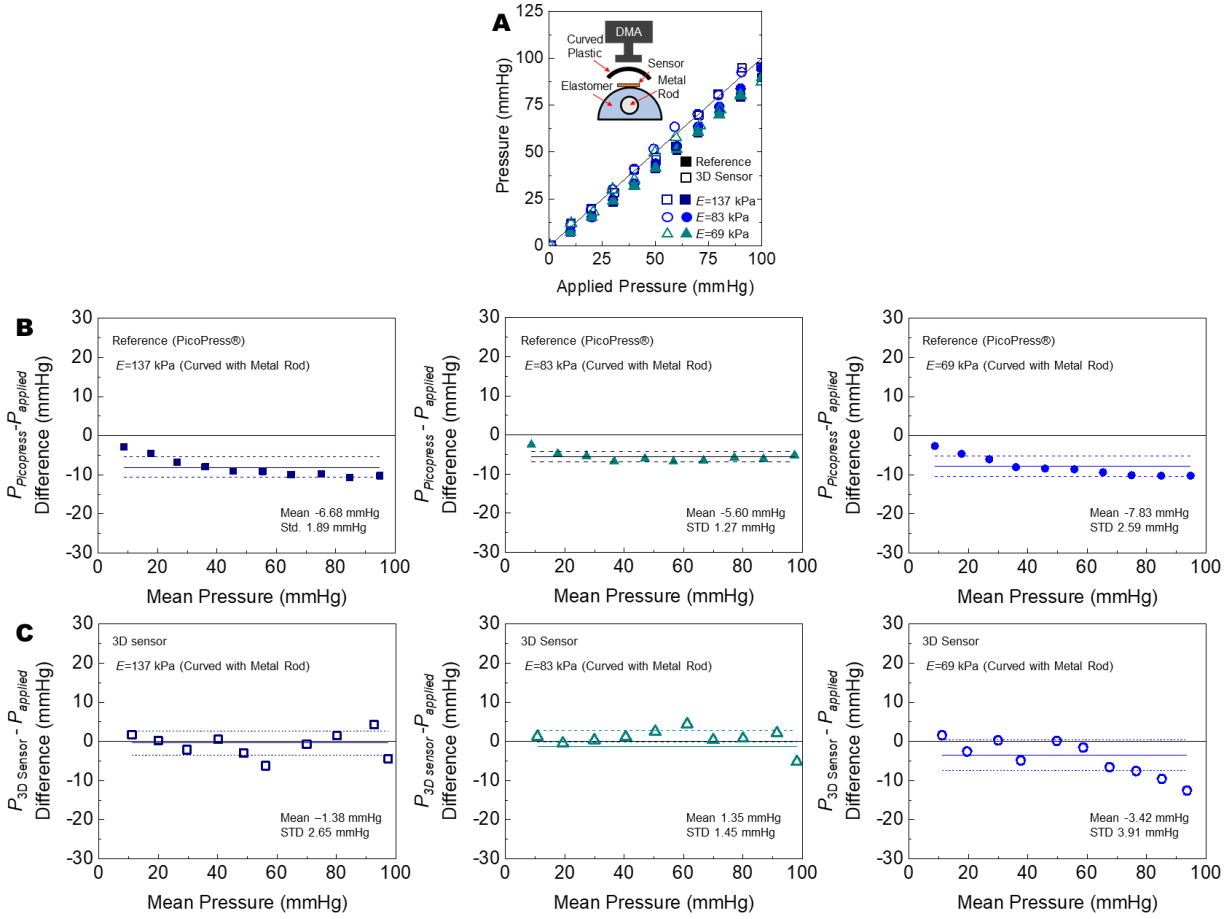

Fig. S13. Optical images of wearing GCS adhering reference equipment and SCV inside. (**A**) Air pocket, air tube and monitor of an air bladder type reference equipment (PicoPress®). (**B**) SCV inside GCS. Photo credit: Yoonseok Park, Northwestern University.

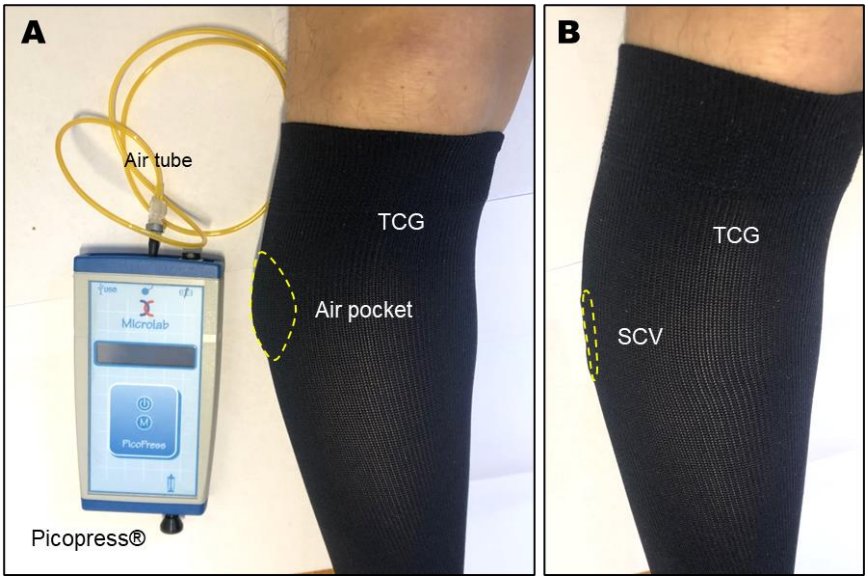

Fig. S14. Schematic and optical images of SCV and a corresponding FEA result. (**A**) Schematic of SCV with a dimensional information of major components. Optical image of (**B**) a SCV and (**C**) on a leg. (**D**) FEA result of distribution of pressure under uniform nominal pressure (30 mmHg) over skin and SCV. Photo credit: Yoonseok Park, Northwestern University.

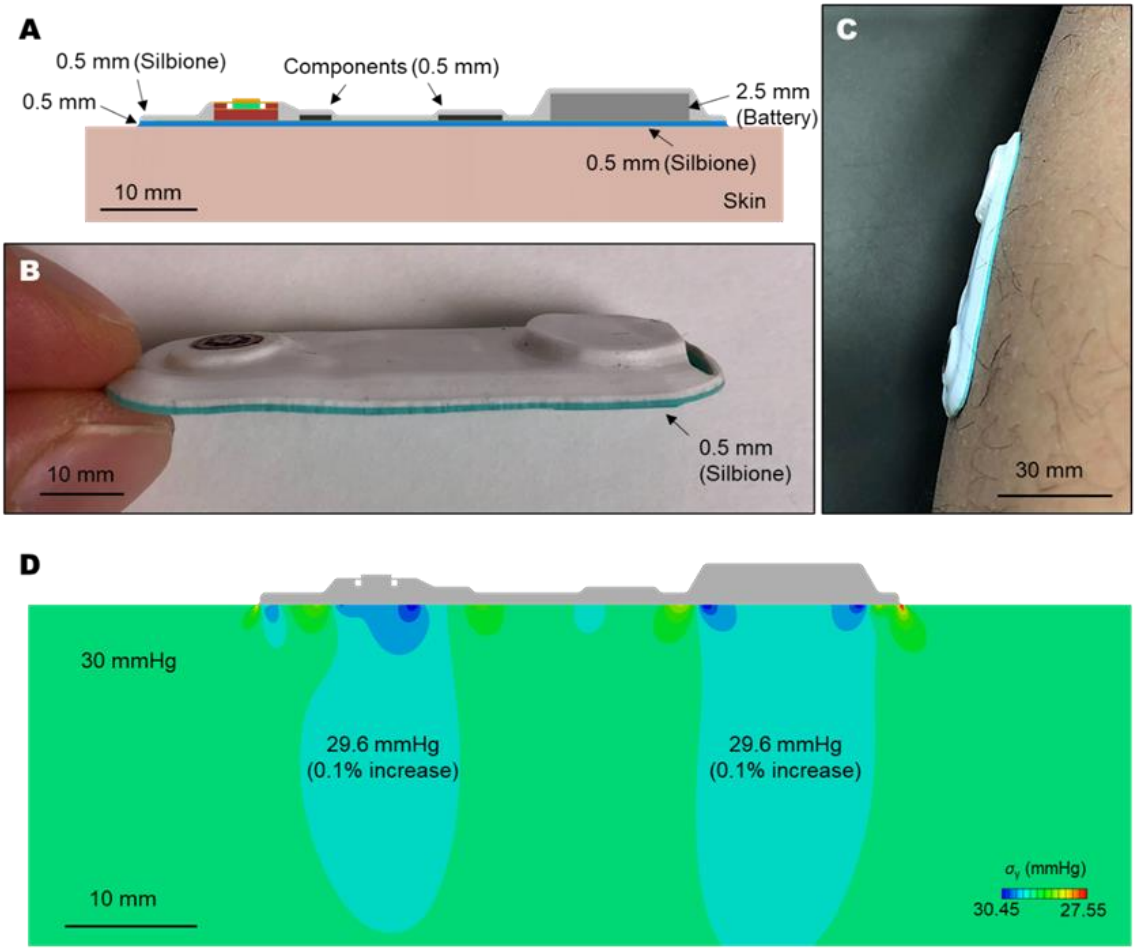

Fig. S15. Optical images of a pressed mark on a leg. After 6 h with SCV while wearing 20-30 mmHg GCS and recovery over time (5, 20 and 30 minutes after relaxion). Photo credit: Yoonseok Park, Northwestern University.

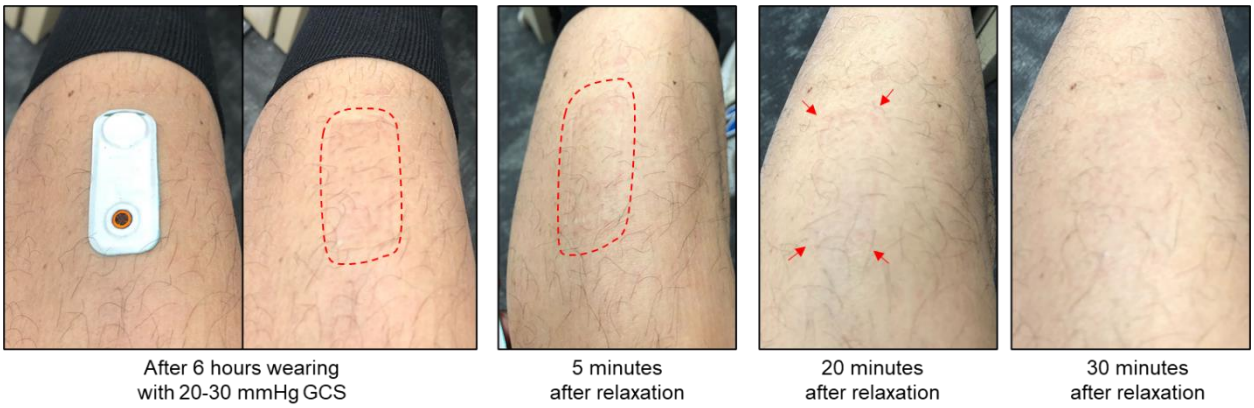

Table S1 Correlation constants for pressure/temperature measurement.

Device Number	Temperature		ADC_{ntc} (32º C)	Pressure			$ADC_{pressure}$ (0 mmHg)
	C_T	n		C_{p1}	C_{p2}	m	
1	0.0049	4257	2273	0.15	0.49	101.7	2161
2	0.0052	3655	2875	0.24	0.41	365.1	2480
3	0.0049	2650	3880	0.22	0.51	401.1	3386
4	0.0049	4150	2380	0.24	0.42	409.6	2045

Table S2 Information of participants who participated in this study.

Participant number	age	Circumstance (Left / Right)		Sex	Ethnicity	Pathology
		Ankle	Calf			
1	89	24 / 24	34 / 34	M	African American	-
2	74	36 / 35	56 / 49	F	African American	Venus leg ulcers
3	87	26 / 25	34 / 34	F	African American	-
4	87	24 / 24	40 / 39	F	South Asian	-
5	69	26 / 26	41 / 40	F	Caucasian	Varicose veins
6	61	27 / 26	40 / 40	M	Caucasian	-
7	62	22 / 22	38 / 39	F	Caucasian	-
8	74	26 / 26	37 / 37	F	Caucasian	-