Supporting Information

For

Stress induced self-rollable smart stent-based U-health platform for in-stent restenosis monitoring

Dong-Su Kim[a,b], Nomin-Erdene Oyunbaatar[a,b], Arunkumar Shanmugasundaram[a,b], Yun-Jin Jeong[a,b], Jongsung Park[c] and Dong-Weon Lee[a,b,d]

[a]MEMS and Nanotechnology Laboratory,
School of Mechanical System Engineering,
Chonnam National University, Gwangju, 61186, Republic of Korea

[b]Advanced Medical Device Research Center for Cardiovascular Disease,
Chonnam National University, Gwangju, 61186, Republic of Korea

[c]Department of Precision Mechanical Engineering,
Kyungpook National University, Sangju, 37224, Republic of Korea

[d]Center for Next-generation Research and Development,
Chonnam National University, Gwangju, 61186, Republic of Korea

Corresponding author
Prof. Dong-Weon Lee. Email: mems@jnu.ac.kr

*To whom all correspondence should be addressed.

Immunocytochemical staining: Immunocytochemical staining was performed using the following antibodies. In a typical process, the cardiomyocytes were placed in a 3.7% formalin solution for 10 min at room temperature and rinsed three times with phosphate-buffered saline (PBS Takara). Permeabilization was performed with 0.1% Triton-X (Sigma–Aldrich) in PBS for 10 min at room temperature. To prevent nonspecific binding, antibodies were incubated at room temperature for 30 min using 3% bovine albumin serum (3% BSA, Sigma–Aldrich). Primary antibodies were used to detect α-actin (1:100, Sigma) and vinculin (1:100, abcam) in the cardiac sarcomere, and Integrin β1 immunostaining (1:100, Sigma) was performed to measure receptor localization. The primary antibodies were diluted in 1% blocking solution and incubated for 1.5 h at room temperature. The secondary antibodies (Alexa-Flour 488 goat anti-mouse IgG conjugate and Alexa-Flour 568 rabbit (1:200, abcam)) were diluted the same blocking solution and incubated for 2 h at room temperature. Finally, the cardiomyocytes were incubated at room temperature for 1.5 h, followed by DAPI staining (Sigma). Subsequently, a fluorescence imaging analysis was performed under a confocal microscope using Leica software.

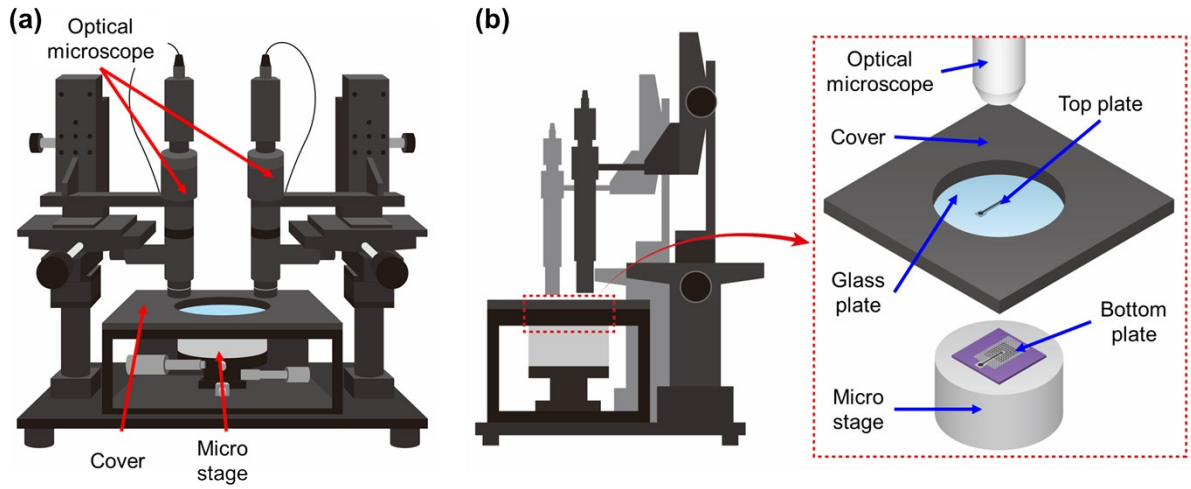

Fig. S1. (a) Schematic shows the modified mask aligner that has been used for precise alignment of the top and bottom capacitor plates. (b) A side-view of the modified mask aligner and a schematic diagram of the adhesion of the top and bottom plates.

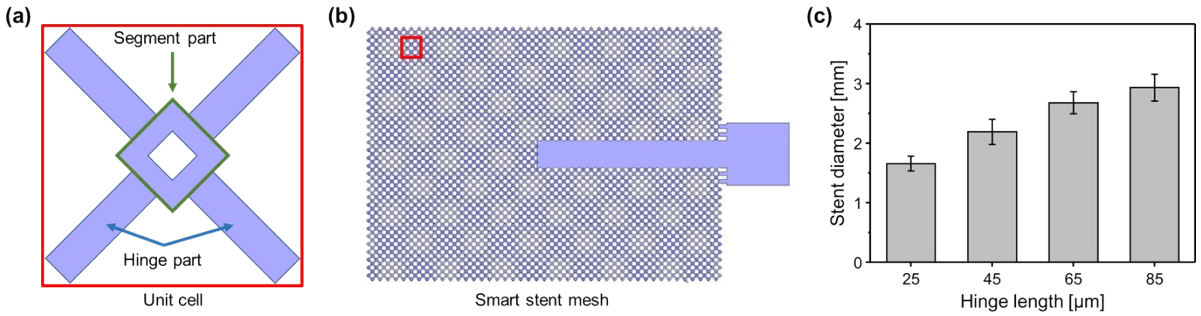

Fig. S2. (a) Schematic shows the unit cell consists of one rigid segment and four flexible hinges. (b) Schematic shows the smart stent mesh composed of several unit cells. (c) Bar plot shows the smart stent diameter according to the different hinge length.

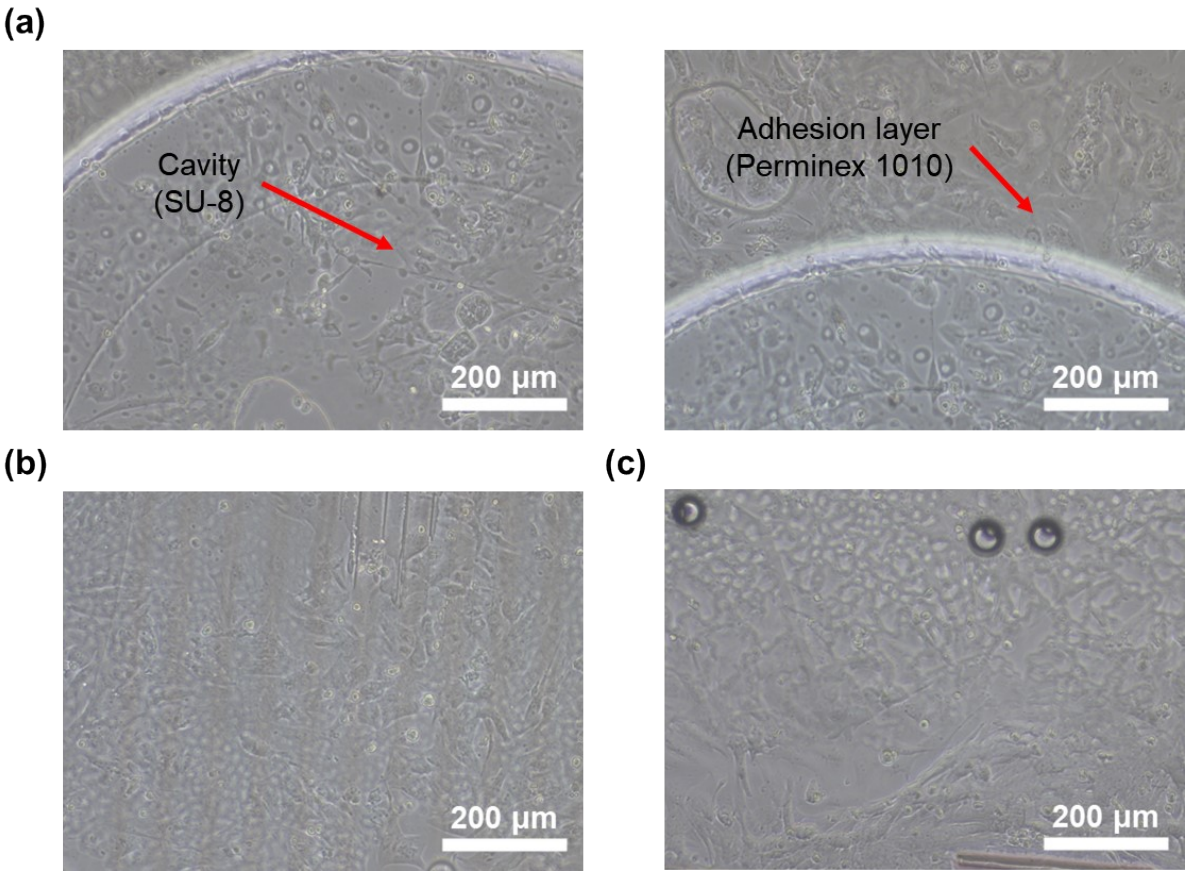

Fig. S3. (a-c) Optical images of the cardiomyocytes cultured on LC-pressure sensor integrated smart stent on culture day 3, 7 and day 10.

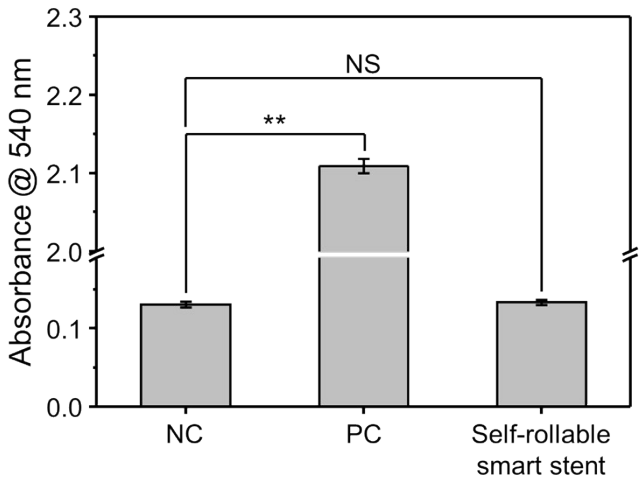

Fig. S4. Hemolytic index of the proposed self-rollable smart stent. NC and PC represents negative control and positive control respectively.

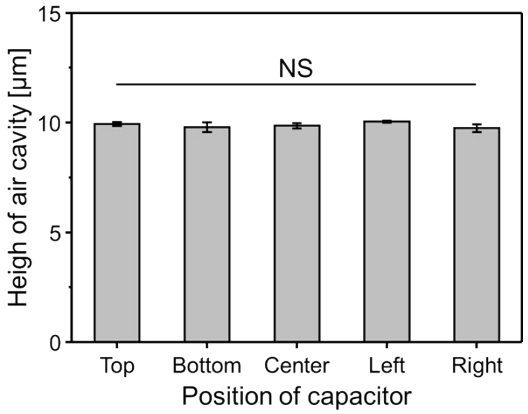

Fig. S5. Air cavity height according to the different positions of the proposed LC-pressure sensor.

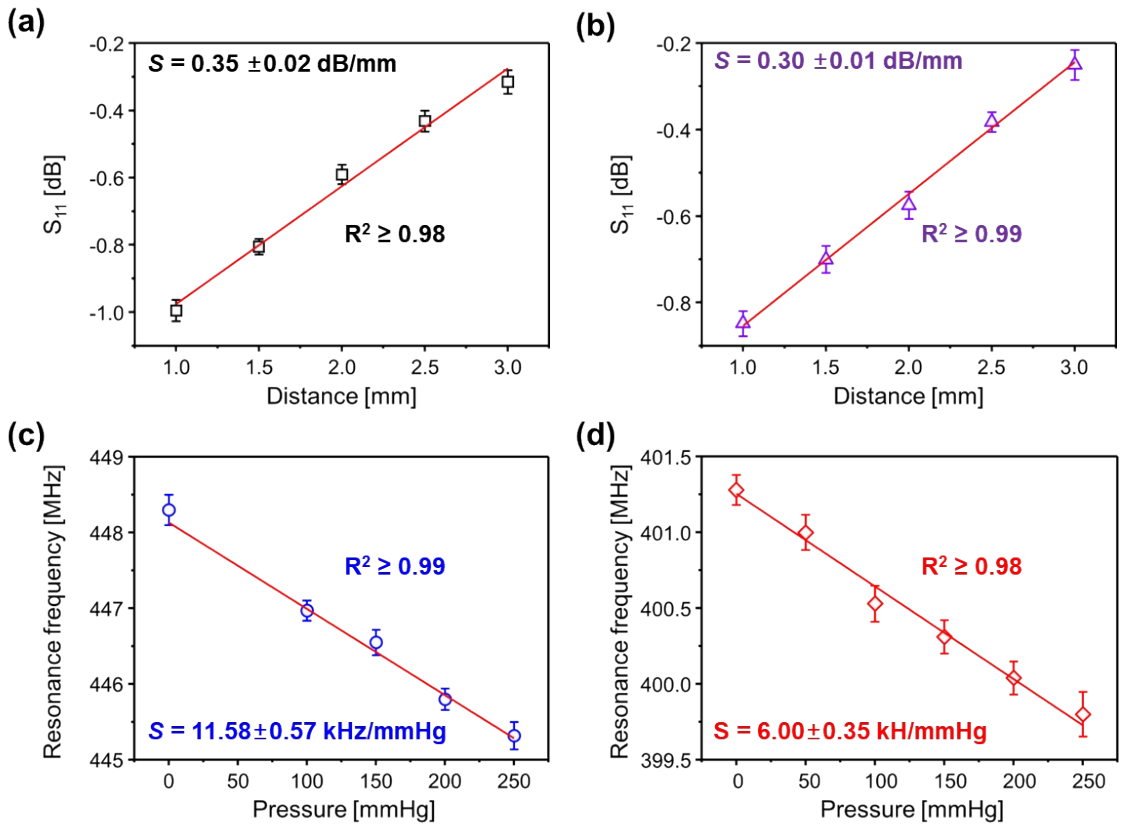

Fig. S6. (a, b) Linear plot shows the relationship of amplitude of the S_{11} and resonance frequency of the fabricated LC-pressure sensor integrated smart at varying external antenna distance and different applied pressure. The sensitivity (S) of the LC-pressure sensor integrated smart stent before and after self-assembling was calculated from the slope of S_{11} amplitude (dB) *vs* external antenna reading distance (mm). The sensitivity of the LC-pressure pressure sensor before and after self-assembling at varying applied pressure was calculated from the slope of resonance frequency (MHz) *vs.* applied pressure (mmHg).

Table S1. The systolic and diastolic blood pressure of a human under various health conditions.

Category	Systolic BP [mmHg]	Diastolic BP [mmHg]
Optimal	< 120	< 80
Normal	120-129	80-84
High mormal	130-139	85-89
Grade1 Hypertension	140-159	90-99
Grade2 Hypertension	160-179	100-109
Grade3 Hypertension	≧ 180	≧ 110
Isolated systolic hypertension	≧ 140	< 90

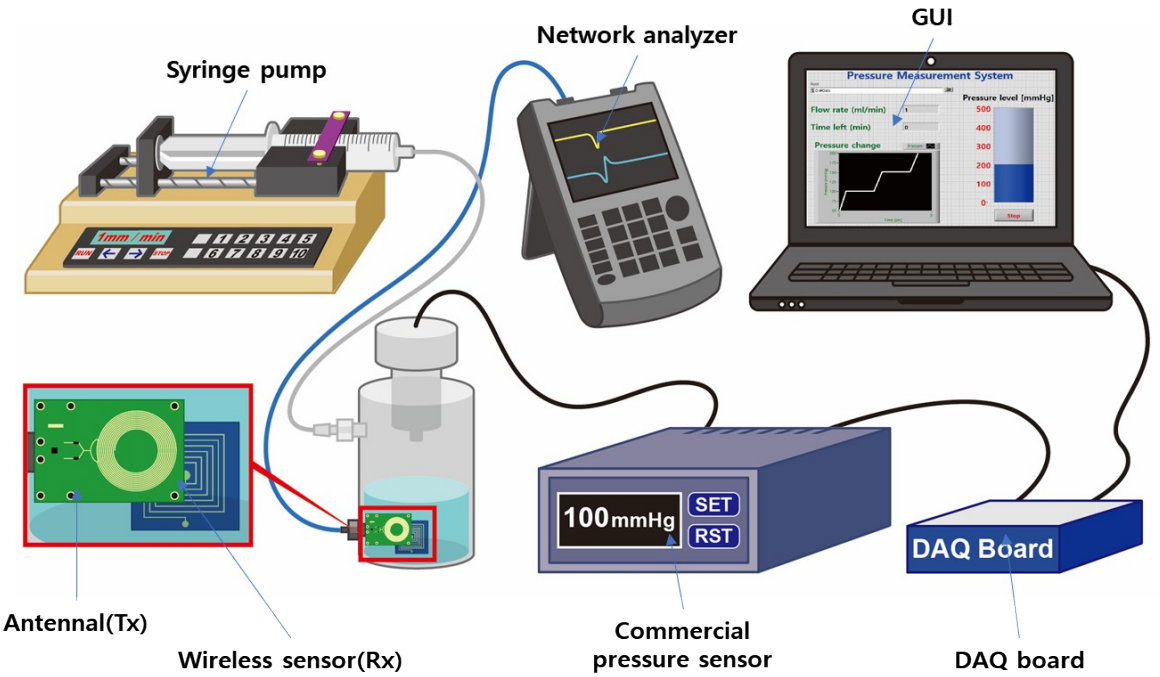

Fig. S7. Schematic shows the experimental setup for the measurement of LC-pressure sensor integrated smart stent in different environments such as deionized water, saline and culture media.

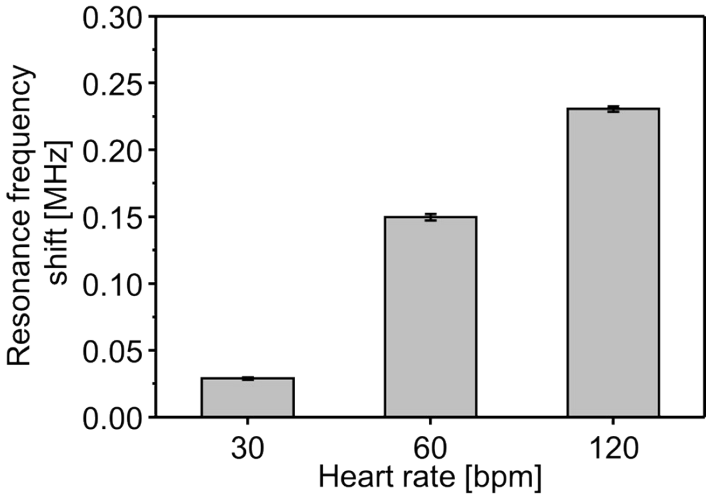

Fig. S8. The bar plot shows the resonance frequency shift of the LC-pressure sensor integrated smart stent at different heart rate such as 30, 60 and 120 bpm.