ACCSCIENCE PUBLISHING

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RESEARCH ARTICLE

Induction and real-time ultrasonic monitoring of 3D cartilage-like tissue by a low shear stresses-based bioreactor

Supplementary file

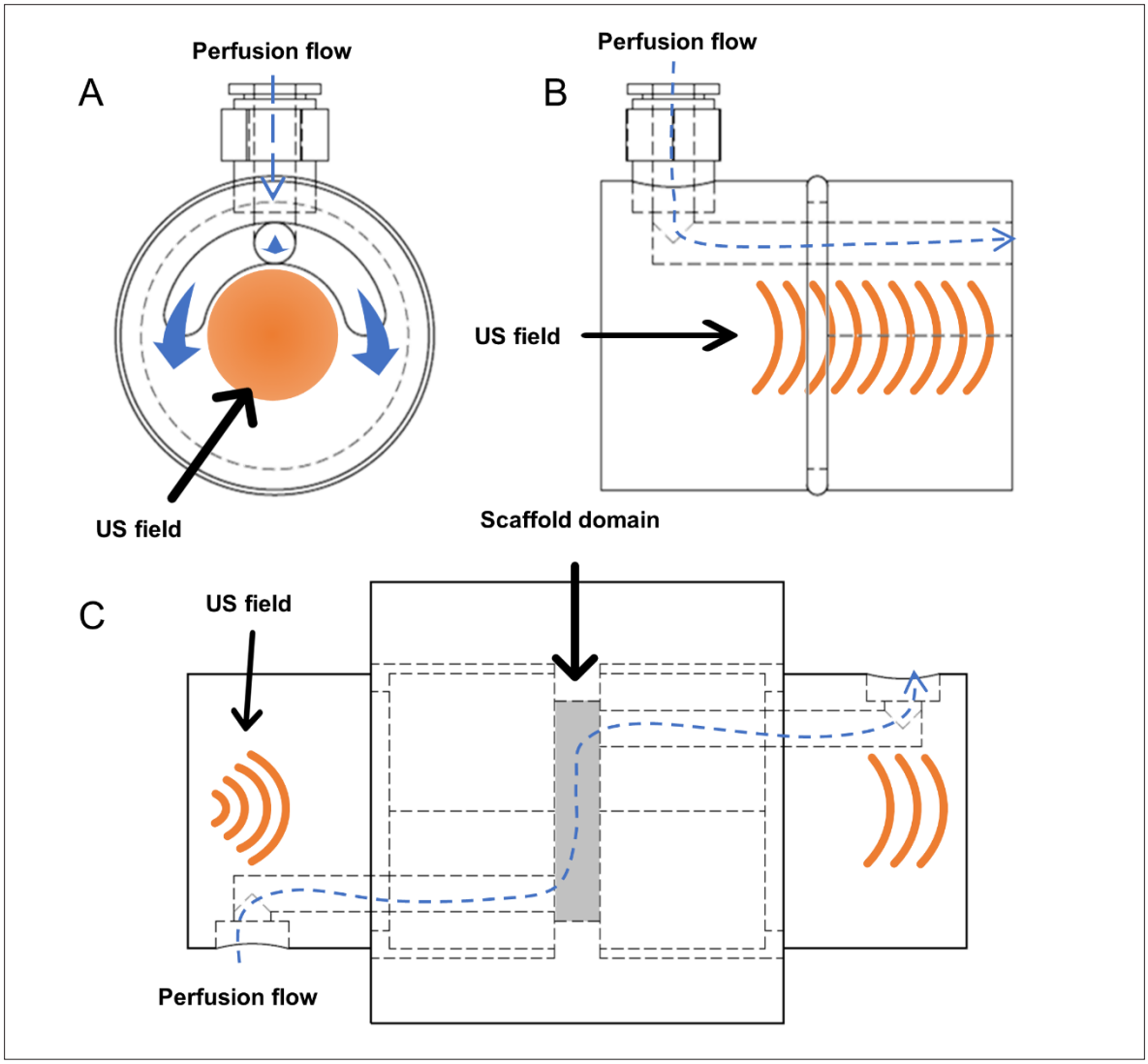

Figure S1. Diagram illustrating the primary functions and designs of the bioreactor. (A) Front view of the input and output (IO) channels. (B) Profile view of the IO channels. (C) Profile view of the scaffold chamber and IO channels. The ultrasound (US) field is represented in orange, whereas the perfusion flow is represented in blue.

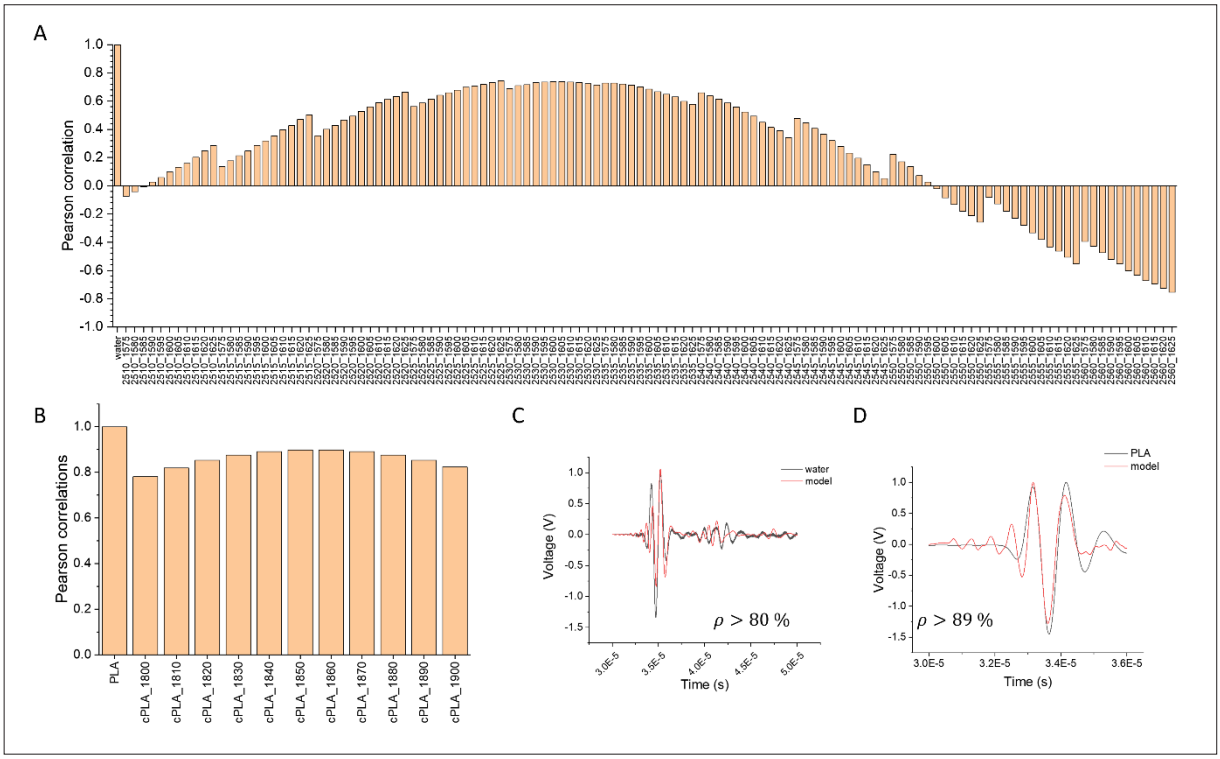

Figure S2. Pearson correlations of control samples. (A) Pearson coefficients (ρ) obtained from Pearson correlation between water experimental signal and finite element model (FEM) synthetic signals. (B) Pearson coefficients obtained from Pearson correlation between polylactic acid (PLA) experimental signal and FEM synthetic signals. (C) Comparison of the experimental water signal with the modeled signal. (D) Comparison of the experimental PLA signal with the modeled signal.

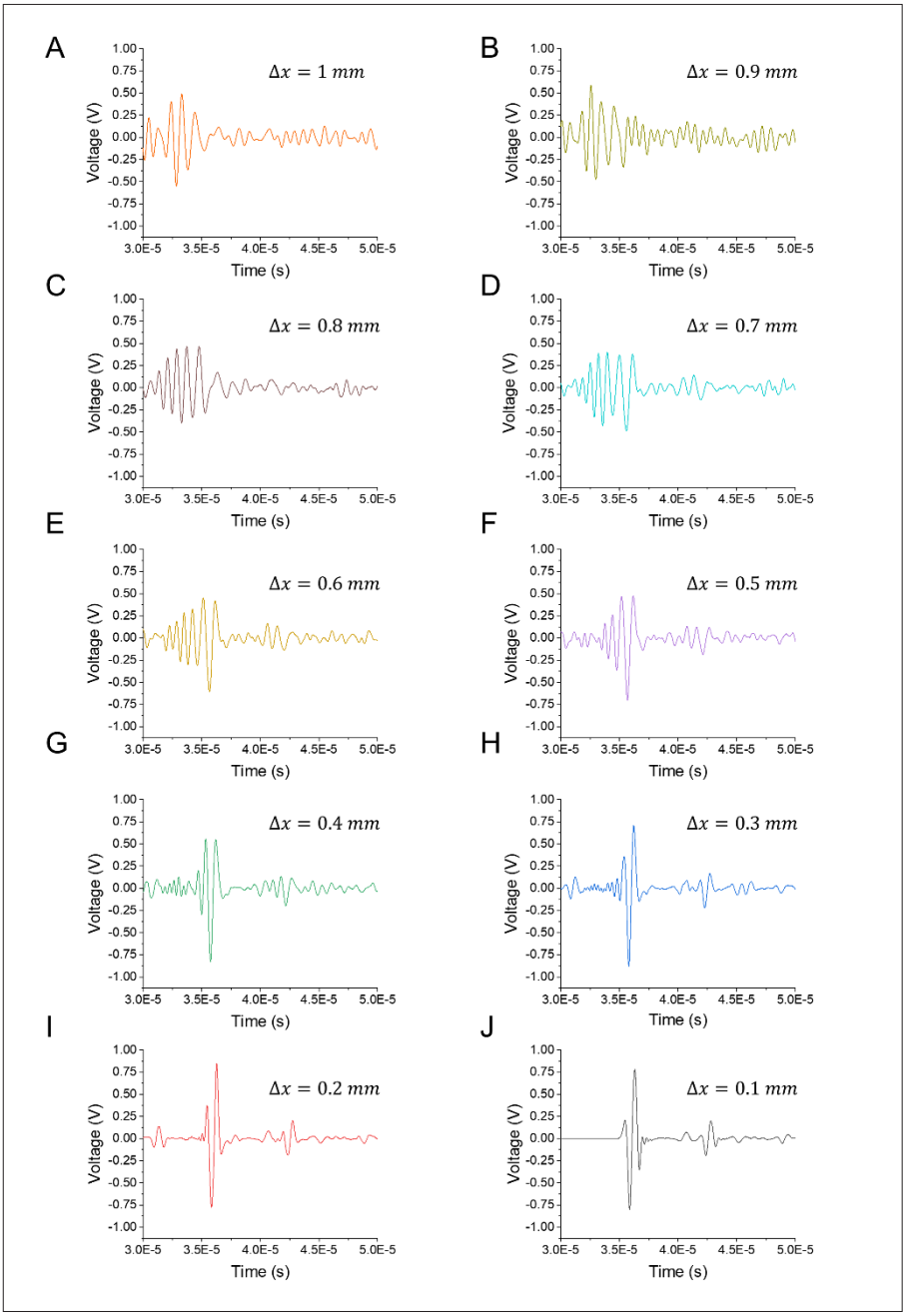

Figure S3. Modeled signals of our pressure wave based on different mesh sizes (Δx), varied from (A–J) 1 to 0.1 mm. Note: Δx refers to the distance of mesh size equivalent in both directions X and Y.

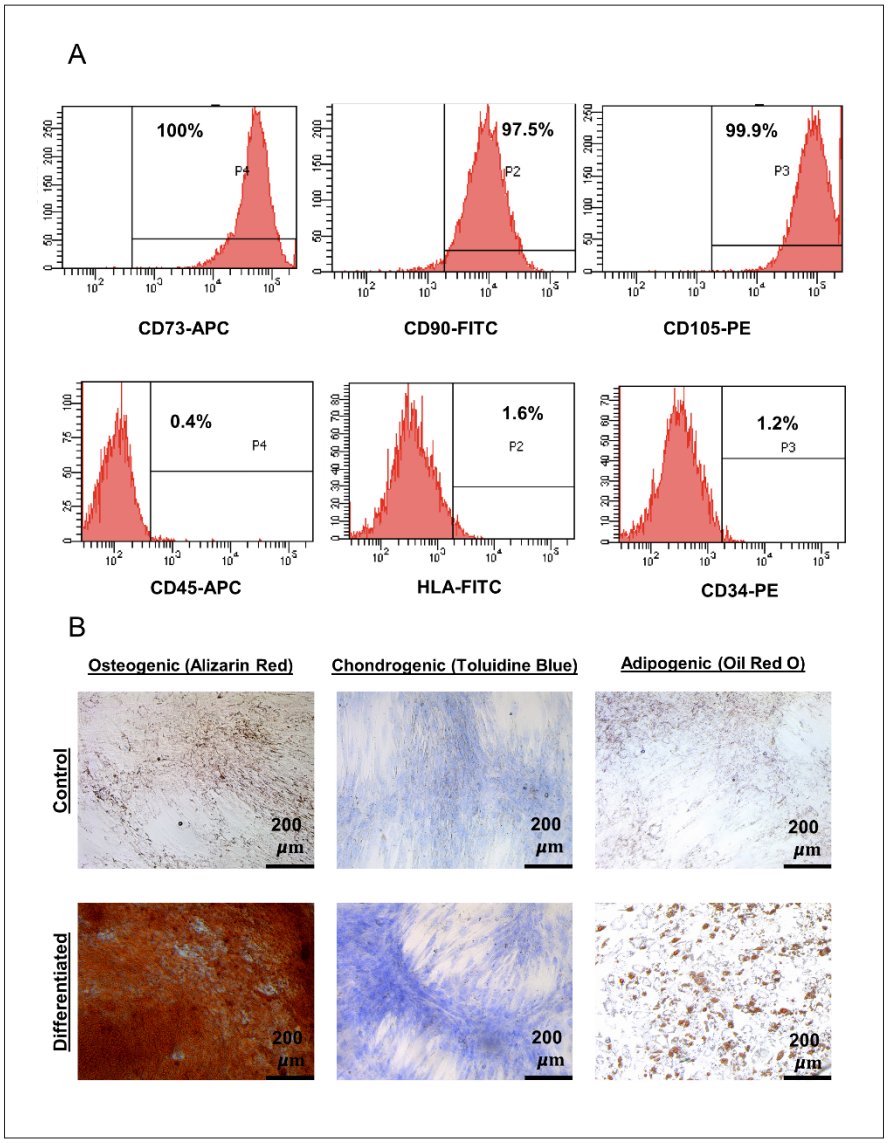

Figure S4. Stemness characterization of IPFP-MSCs. (A) Fluorescence-activated cell sorting (FACS) markers for stemness. (B) Differentiation capacity. Control: infrapatellar fat pad mesenchymal stem cells (IPFP-MSCs) with Dulbecco's Modified Eagle Medium (DMEM), 10% fetal bovine serum (FBS), and 1% Penicillin-Streptomycin (P/S). Differentiated: Osteogenic medium: StemMACS OsteoDiff (130-091-678; Miltenyi, Germany); Adipogenic medium: StemMACS AdipoDiff (130-091-677; Miltenyi, Germany); Chondrogenic medium: DMEM supplemented with 10 ng/mL TGF-β1, 0.1 μM dexamethasone, 40 μg/mL L-proline, 50 μg/mL L-ascorbate-2-phosphate, and 50 mg/mL insulin, transferrin, and selenium (ITS). Scale bars: 200 μm.

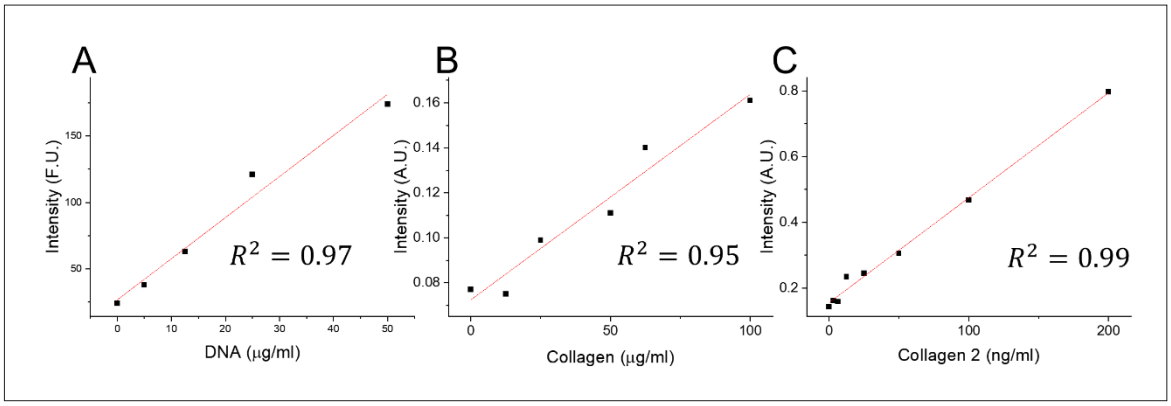

Figure S5. Calibration curves for the quantification assays. (A) Standard curve of DNA quantification. DNA content was estimated using a fluorometric marker (DAPI staining), and a DNA standard curve was constructed using DNA from calf thymus (Sigma-Aldrich, United States of America [USA]). (B) Standard curve of general collagen quantification. Collagen content was measured via Sirius Red assay. The absorbance of the supernatant was measured in a microplate reader at 540 nm (Synergy HT, BIO-TEK, USA). For standard collagen, calfskin was used (Sigma-Aldrich, USA). (C) Standard curve of collagen type II quantification following manufacturer's protocols (Chondrex, USA). R^2 is the coefficient of determination for linearity; 1 denotes complete linearity; 0 denotes non-linearity.

Supplementary videos

Video S1. Simulation of the infill problem with air liquid interface.
Video S2. Shear stresses exerted during the infill problem.
Video S3. P-wave propagation in the BR model