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Electronic Supplementary Information

Analytical Investigation of Nano-Bio Interfacial Protein Mediation for Fibroblast Adhesion on Hydroxyapatite Nanoparticles

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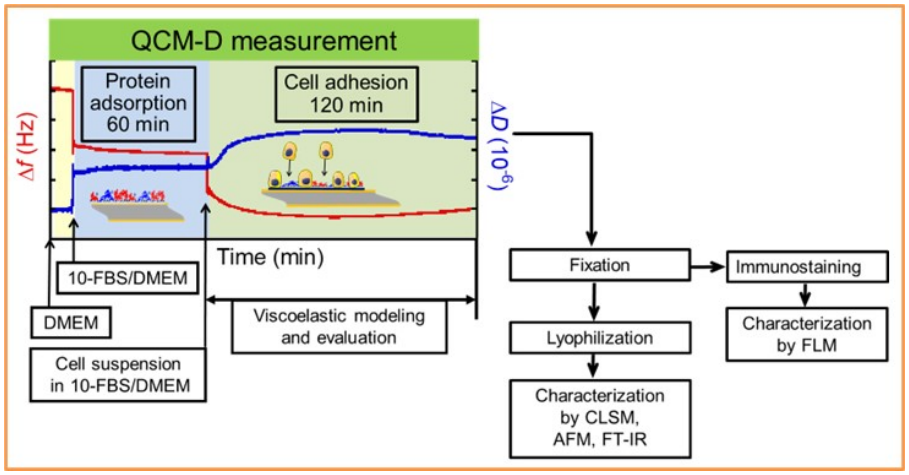
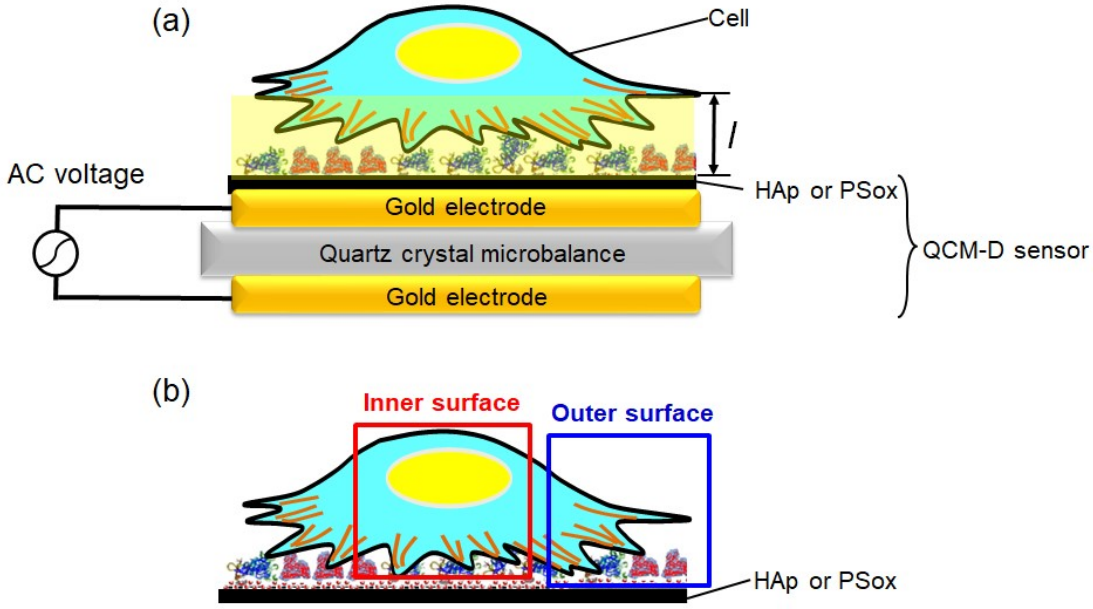
Scheme S1



Scheme S1 Illustration of the QCM-D measurement procedure for the FBS protein adsorption, cell adhesion and subsequent other characterization methods in this study.

Scheme S2



Scheme S2 (a) Illustration of the interfacial measurement height (*l*) of the cell adhesion and protein adsorption layers on HAp or Pox using a QCM-D technique. (b) Illustration of the measurement parts of the inner (red-color square mark) and outer (blue-color square mark) surfaces of the cell using a localized FT-IR spectroscopy, which were captured as the aperture size of 50×50 μm^2 and screen size of 359×476 μm^2.

Figure S1

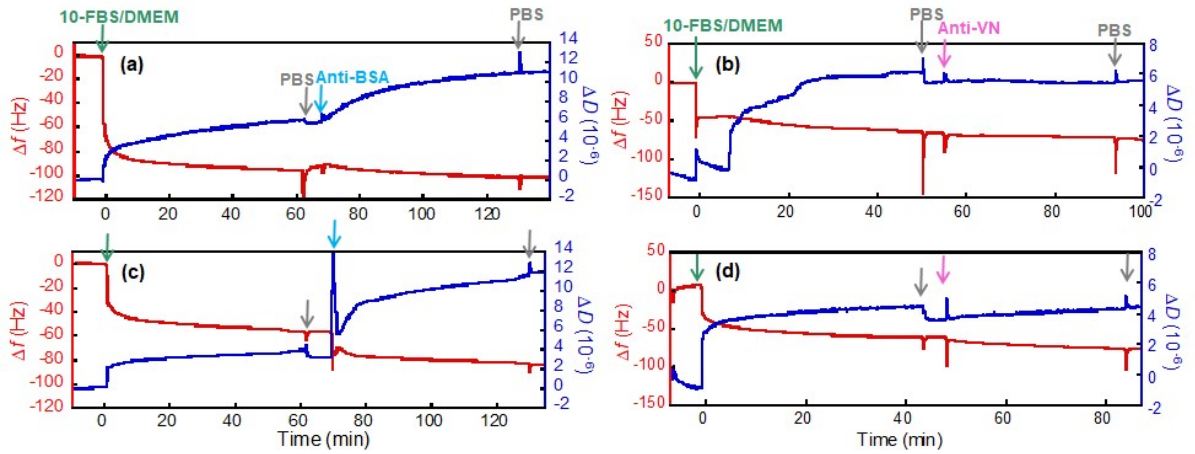


Fig. S1 *Δf* (red line) and *ΔD* (blue line) curves with the adsorption of (a, c) Anti-BSA and (b, d) Anti-VN on (a, b) FBS-HAp and (c, d) FBS-PSox and subsequent buffer wash by PBS.

Figure S2

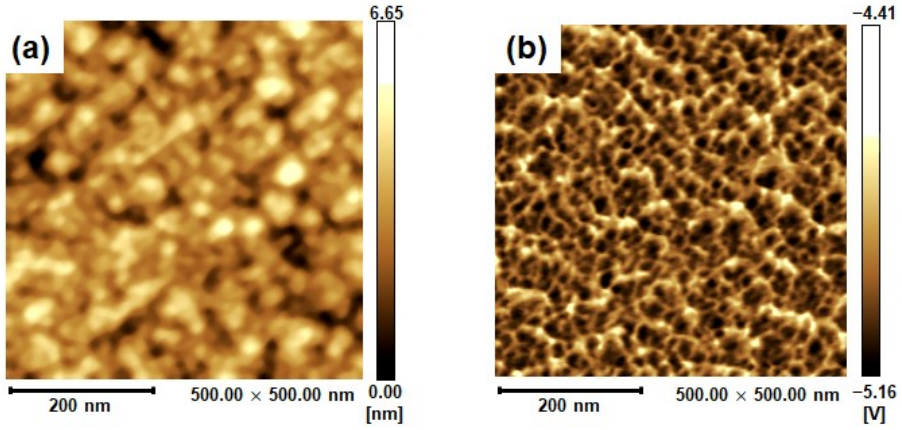


Fig. S2 AFM (a) topographic and (b) phase-shift images of the FBS-PSox.

Figure S3

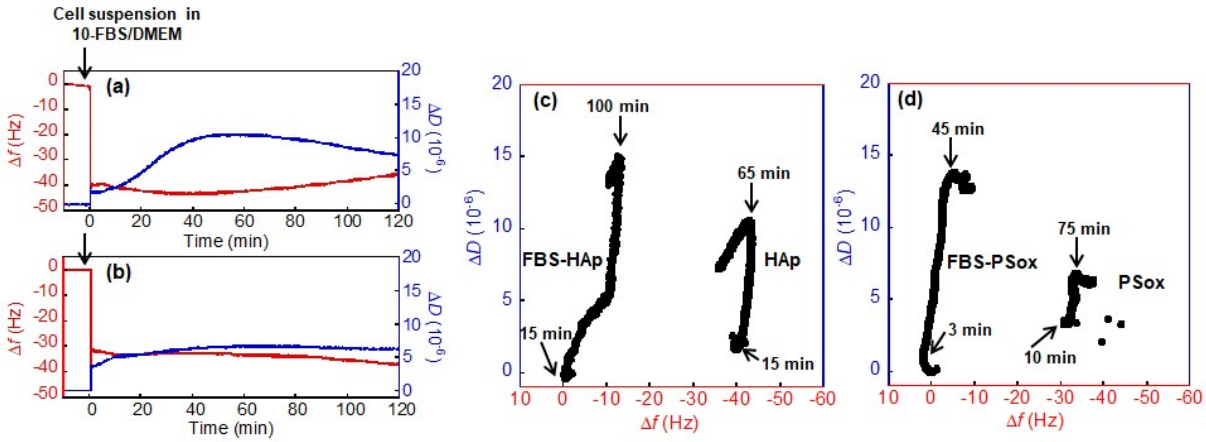


Fig. S3 (a, b) *Δf* (red line) and *ΔD* (blue line) curves with the cell adhesion on (a) HAp and (b) Psox, and (c, d) *ΔD*−*Δf* plots with the cell adhesion on (c) FBS-HAp and HAp and (d) FBS-Psox and Psox (cell seeding concentration: 10.0×10^4 cells/mL).

Figure S4

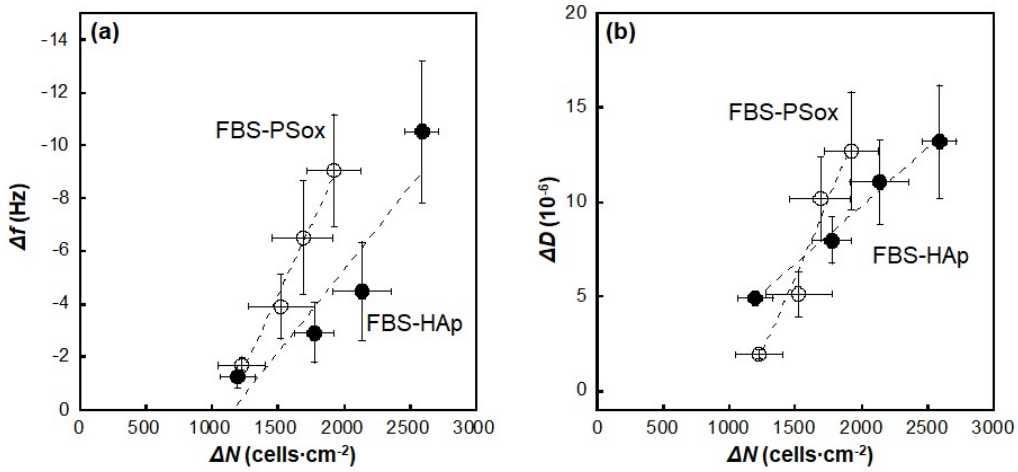


Fig. S4 (a) *Δf*−*ΔN* and (b) *ΔD*−*ΔN* plots of the cells adhered on FBS-HAp (●) and FBS-PSox (○). There were linear relationships between Δ*f* and Δ*N*, and Δ*D* and Δ*N*. The values of Δ*f*/Δ*N* and Δ*D*/Δ*N* were −6.3 × 10^{-3} (*R*=0.93) and 6.1 × 10^{-3} (*R*=0.99), and −10.8 × 10^{-3} (*R*=0.99) and 16.3 × 10^{-3} (*R*=0.98) for FBS-HAp and FBS-PSox, respectively.

Figure S5

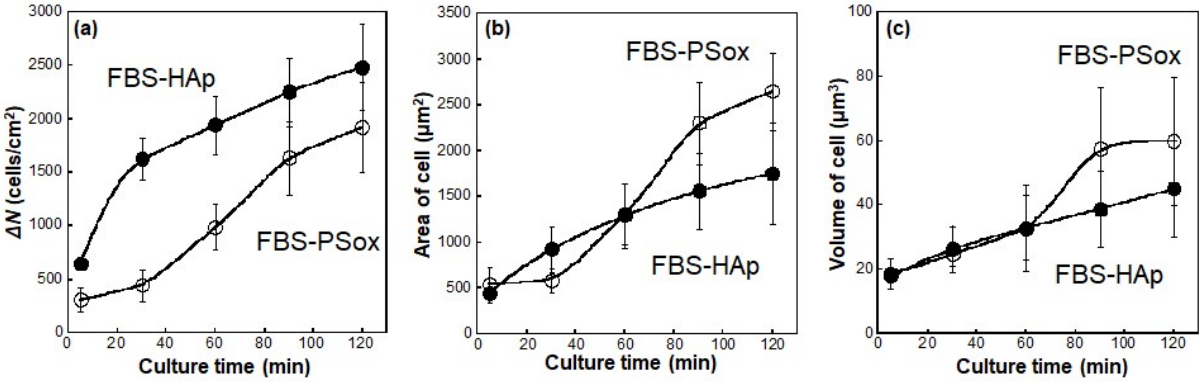


Fig. S5 (a) *ΔN*, (b) area and (c) volume changes of the cells adhered on FBS-HAp (●) and FBS-PSox (○) with the culture time.

Figure S6

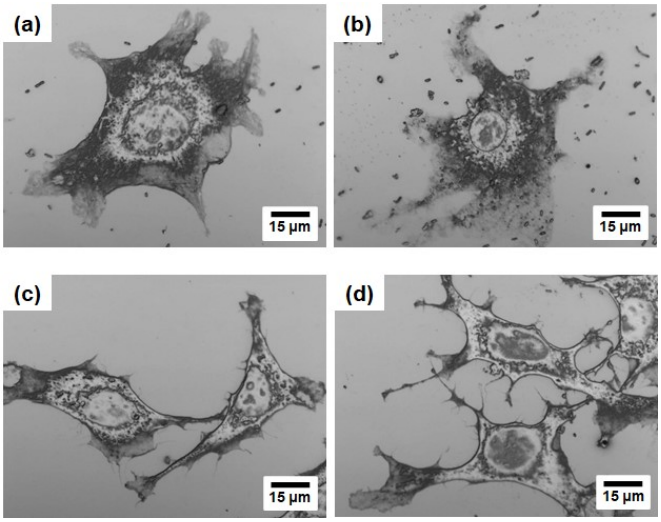


Fig. S6 CLSM images of the morphological observation of the cells adhered on (a, b) FBS-HAp and (c, d) FBS-PSox in the different positions at the culture time of 120 min.

Figure S7

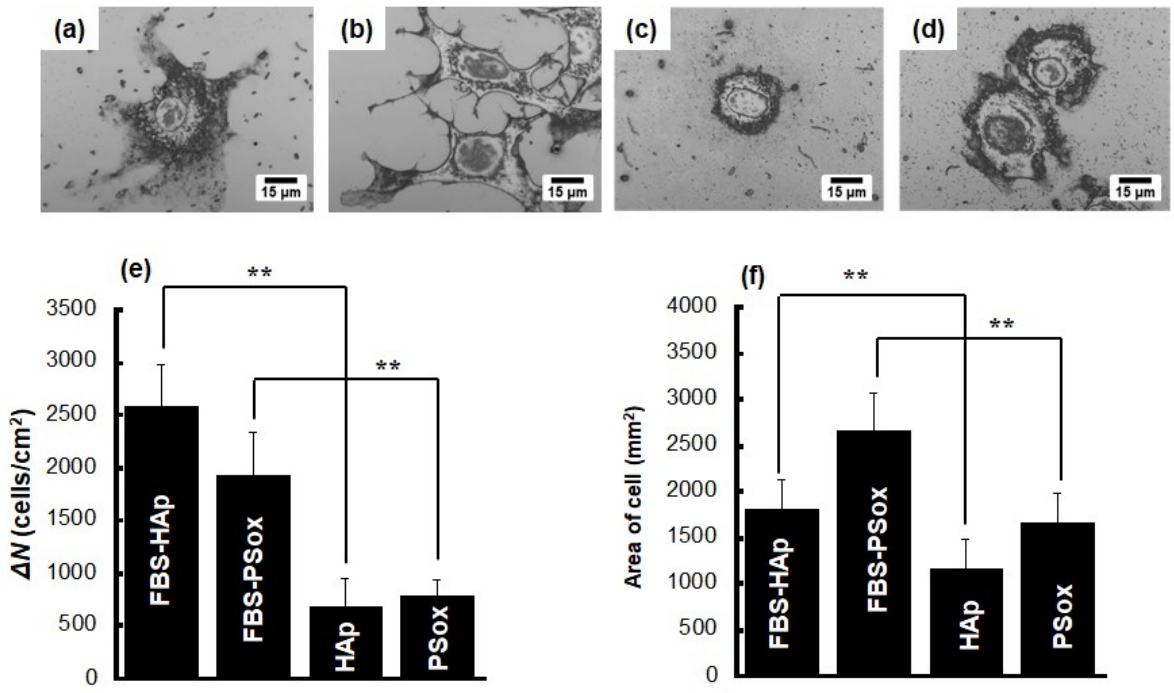


Fig. S7 CLSM images of the morphological observation of the cells adhered on (a) FBS-HAp, (b) FBS-PSox, (c) HAp and (d) Psox at 120 min. (e) *ΔN* and (f) area of the cell adhered on the surfaces. ** indicates $P < 0.01$.

Table S1

Table S1 The ascription of the localized FT-IR spectral absorption bands of the cells adhered on FBS-HAp.

Wavenumber (cm^{-1})	Ascription
3500, 3300 cm^{-1}	Hydrogen bonded N–H, N–H stretching of amide A
2960, 2925, 2853 cm^{-1}	Alkyl chain C–H stretching
1745 cm^{-1}	Stretching vibrations of –COOH or H_2O
1658 cm^{-1}	Amide I (C=O stretching)
1546 cm^{-1}	Amide II (N–H bending/C–N stretching)
1460, 1395 cm^{-1}	Scissoring of CH_2 wag, υ_s COO^- stretching
1262 cm^{-1}	Amide III (N–H deformation)
1235 cm^{-1}	Phospholipids in cell membrane (P=O)
1175 cm^{-1}	Presence of alcohol groups (C–OH)

Table S2

Table S2 The ascription of the localized FT-IR spectral absorption bands of the cells adhered on FBS-PSox.

Wavenumber	Attribution
3500, 3300 cm^{-1}	Hydrogen bonded N−H, N−H stretching of amide A
2960, 2873 cm^{-1}	Alkyl chain C−H stretching
1660 cm^{-1}	Amide I (C=O stretching)
1540 cm^{-1}	Amide II (N−H bending/C−N stretching)
1395 cm^{-1}	$\upsilon_s COO^-$ stretching
1262 cm^{-1}	Amide III (N−H deformation)
1170 cm^{-1}	Presence of alcohol groups (C−OH)
1080 cm^{-1}	Psox (C−O stretching)

Figure S8

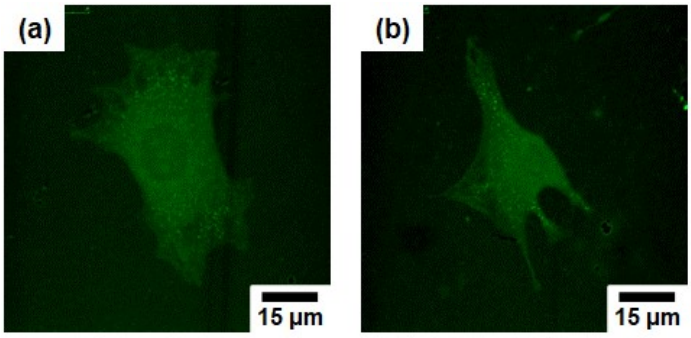


Fig. S8 FLM images of the cells adhered on (a) FBS-HAp and (b) FBS-PSox at the culture time of 120 min. The cells were stained with the polyclonal rabbit anti-mouse collagen type I α_2 chain as a primary antibody and the FITC-labeled IgG as a secondary antibody.