Supporting Information

Facile and Versatile Strategy for Construction of Anti-Inflammatory and Antibacterial Surfaces with Polydopamine-Mediated Liposomes Releasing Dexamethasone and Minocycline for Potential Implant Applications

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MATERIALS AND METHODS

Quartz Crystal Microbalance and Chips.

The quartz crystal microbalance (QCM) and chips (AT cut, 5 MHz) were obtained from Dongwei Biological Technology Co. Ltd. (Hangzhou, China). The diameter of chips was 14 mm. An UV/ozone Tip-Cleaner (BioForce Nanosciences, Ames, IA, USA) was used to clean QCM chips for 30min prior to use. Then the chips were fully washed with DI water and ethanol thrice followed by drying under nitrogen gas flow. Piezoelectric influence is the basis of QCM, and the deposited mass is directly proportional to the frequency changes. Previously published method was applied to count the adsorbed mass.[1] Briefly, the equation is as follows: $\Delta m = - C\Delta f/n$. Herewith, n is the number of overtone. Δm is the mass change of per unit surface area and Δf denotes the frequency change. C, the constant of QCM sensitivity, equals 17.7 ng/cm^{-2} Hz^{-1}. Simultaneously, the base frequency of 15 MHz (n = 3) was acquired.

The rinsed chips were placed onto the QCM. The pDA coating and liposomes modification were produced as mentioned above. The frequency and mass change were monitored by QCM. Three chips were used in each group and the average values were calculated.

References:

(1) Zhou, P.; Deng, Y.; Lyu, B.; Zhang, R.; Zhang, H.; Ma, H.; Lyu, Y.; Wei, S. Rapidly-Deposited Polydopamine Coating via High Temperature and Vigorous Stirring: Formation, Characterization and Biofunctional Evaluation. *PLoS One* **2014**, *9*, No. e 113087.

Figure Captions

Figure S1. Liposome formulations.

Figure S2. Representative images of water droplet on the modified PS surfaces followed with water contact angle measurements. 1.0 represents the concentration of grafted liposomes (1.0 mg/mL).

Figure S3. EDS spectrum of Dex/Mino liposome-modified surface, revealing the presence of phosphorus (P) (absent in the inset of the EDS of a pDA-coated surface without liposome immobilization). Au (gold) was used to coat the samples.

Figure S4. (a, c, e) Representative frequency change vs time (min) curves. (b, d, f) The mass change of QCM chips coated by pDA and liposomes, respectively. In the figure, 0.2, 0.5, and 2.0 represent the different concentrations of grafted liposomes (mg/mL). $^{**}p < 0.01$ compared with chips coated by pDA. All data represent mean ± SD ($n = 3$).

Figure S5. Antibacterial activity of pristine and functionalized PS samples against (a) Gram-negative *P. gingivalis* and (b) Gram-positive *S. mutans* cultured for 4 and 24 h in suspension. 1.0 refers to the concentration of grafted liposomes (1.0 mg/mL). *Statistical significance level between the PS group and PS-1.0 blank liposome group or the PS-1.0 Dex/Mino liposome group ($^{**}p < 0.01$). All data represent mean ± SD ($n = 3$).

Figure S1.

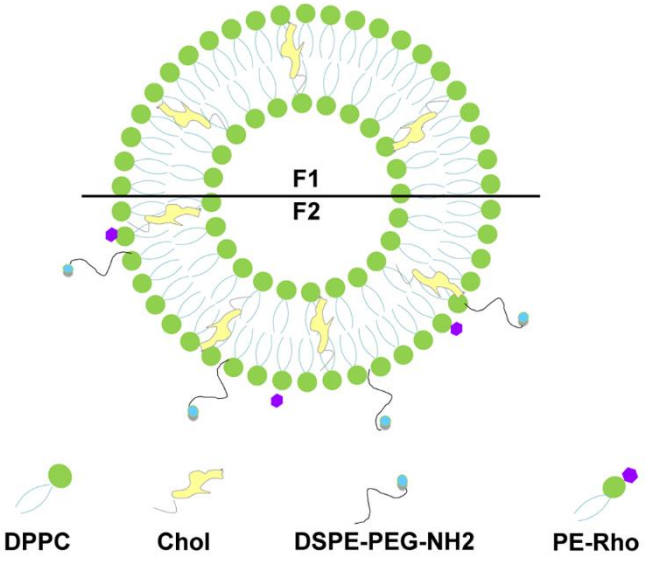

Figure S2.

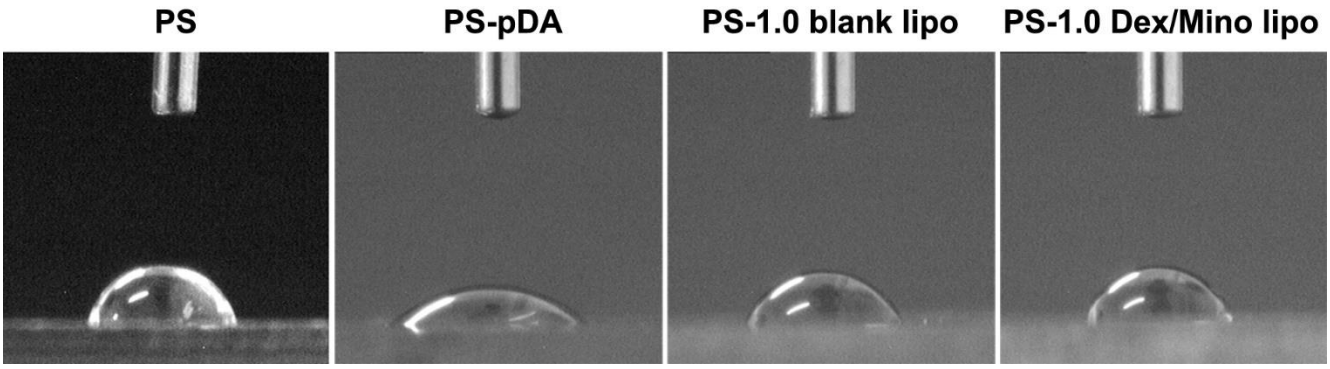

Figure S3.

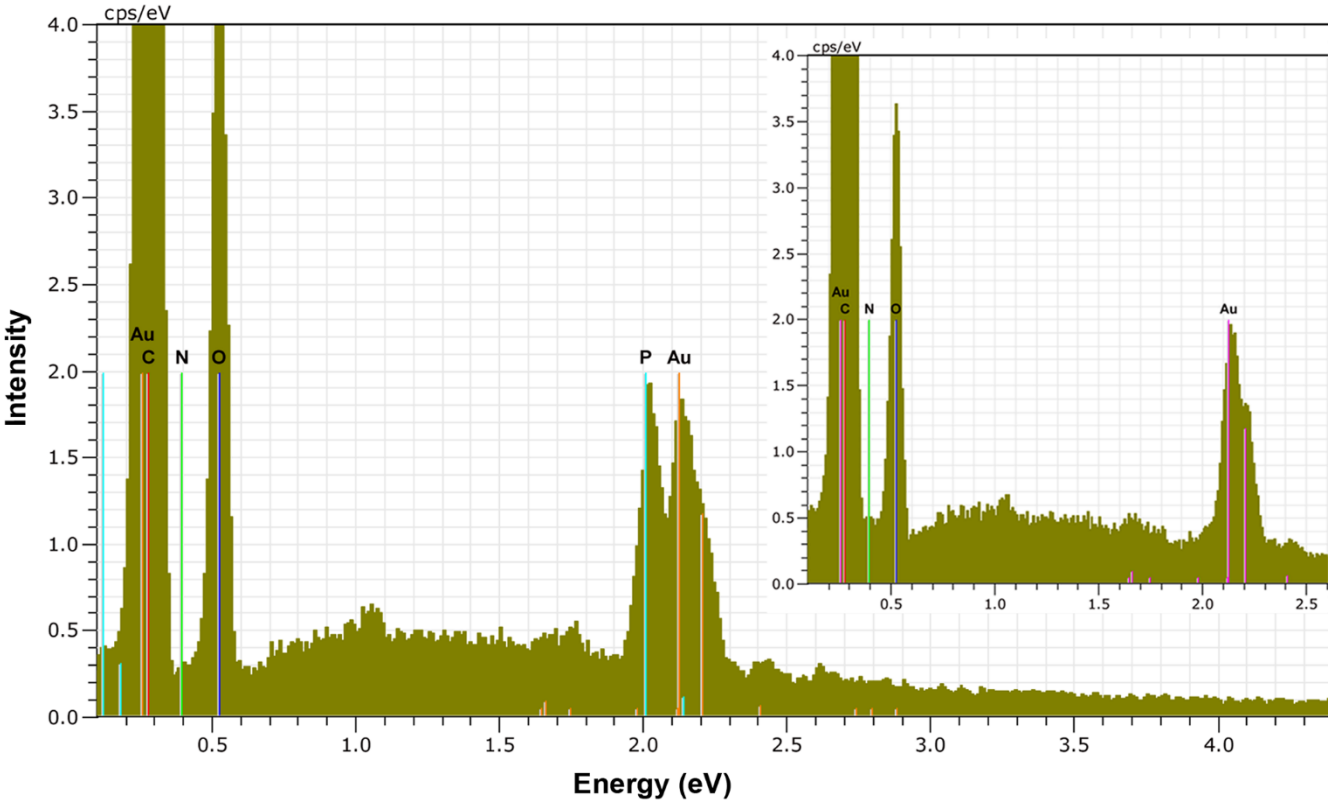

Figure S4.

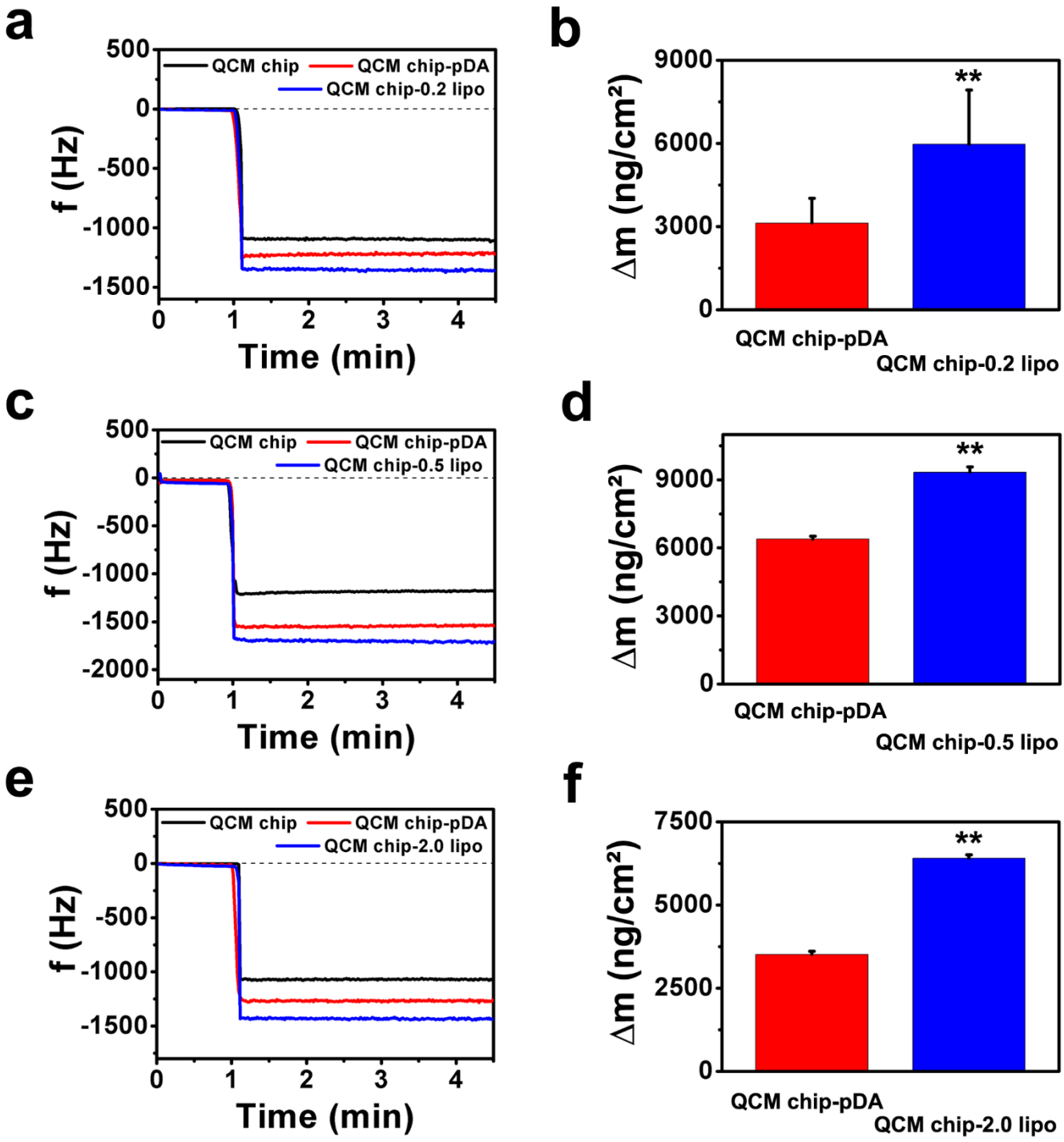
a
QCM chip
QCM chip-pDA
QCM chip-0.2 lipo
f (Hz)
Time (min)
b
Δm (ng/cm²)
**
QCM chip-pDA
QCM chip-0.2 lipo
c
QCM chip
QCM chip-pDA
QCM chip-0.5 lipo
f (Hz)
Time (min)
d
Δm (ng/cm²)
**
QCM chip-pDA
QCM chip-0.5 lipo
e
QCM chip
QCM chip-pDA
QCM chip-2.0 lipo
f (Hz)
Time (min)
f
Δm (ng/cm²)
**
QCM chip-pDA
QCM chip-2.0 lipo

Figure S5.

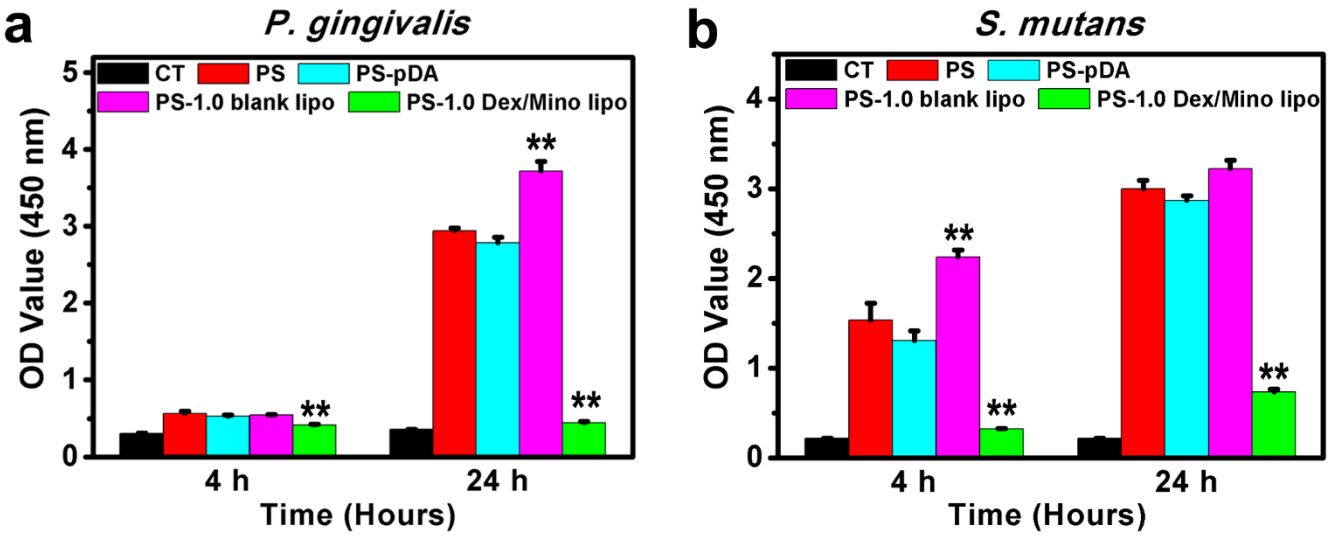
a
P. gingivalis
CT
PS
PS-pDA
PS-1.0 blank lipo
PS-1.0 Dex/Mino lipo
OD Value (450 nm)
0
1
2
3
4
5
**
**
4 h
24 h
Time (Hours)
b
S. mutans
CT
PS
PS-pDA
PS-1.0 blank lipo
PS-1.0 Dex/Mino lipo
OD Value (450 nm)
0
1
2
3
4
**
**
**
4 h
24 h
Time (Hours)

Table S1. Liposome formulations (values denoted as a molar ratio).

	DPPC	**Chol**	**DSPE-PEG-NH_2**	**PE-Rho**
F1	2	1	-	-
F2	1.85	1	0.15	0.002

Table S2. Characterization of liposomes.

Liposomes	Particle size (nm)	Polydensity index	ζ potential (mV)
Dexamethasone liposomes	168.06 ± 4.61	0.220 ± 0.028	-1.11 ± 0.28
Minocycline liposomes	165.76 ± 2.17	0.157 ± 0.016	-1.56 ± 0.08
PE-Rho-Dex/Mino liposomes	196.36 ± 1.56	0.215 ± 0.049	-2.33 ± 0.02

Data are presented as mean ± SD (n = 3).

Table S3. Primer sequences used for RT-PCR analysis.

Genes	5′-3′	Primes
Interleukin-6 (IL-6)	Forward	GTGAGGAACAAGCCAGAGC
	Reverse	TACATTTGCCGAAGAGCC
Interleukin-8 (IL-8)	Forward	TTTTGCCAAGGAGTGCTAAAGA
	Reverse	AACCCTCTGCACCCAGTTTTC
Tumor necrosis factor-α (TNF-α)	Forward	CGAGTGACAAGCCTGTAGCC
	Reverse	TGAAGAGGACCTGGGAGTAGAT
Cyclooxygenase-2 (COX-2)	Forward	CTGGCGCTCAGCCATACAG
	Reverse	ACACTCATACATACACCTCGGT
β-actin	Forward	CCCAGAGCAAGAGAGG
	Reverse	GTCCAGACGCAGGATG