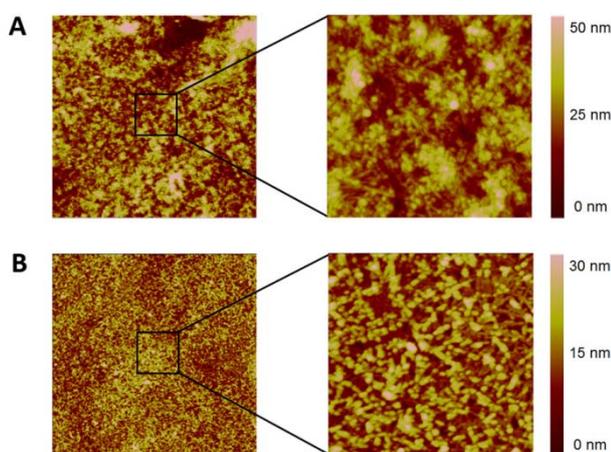


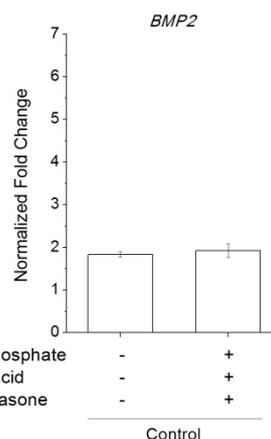
Supported information

Procedure for QCM-D

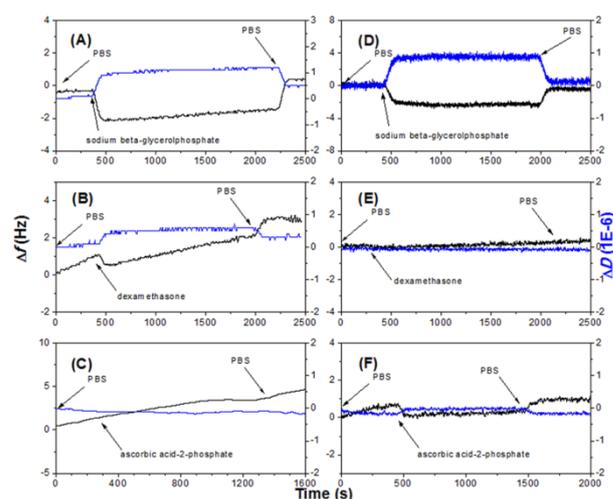
To prepare the TMV modified Gold sensors for QCM-D measurements, the fresh cleaned gold crystals were immersed in 0.1 M cysteamine ethanol solution for 48 h, rinsing with ethanol and deionized water, and blow-drying with a stream of nitrogen. The sensors were then immersed in TMV solution for 1 h (0.5 mg/mL, pH 4.7 in 0.1 M potassium phosphate buffer), rinsing with deionized water and drying with nitrogen, then the sensor was mounted in a QFM 401 chamber (Q-Sense, Gothenburg, Sweden). Before and after each introduction of special components separately (dissolved in 0.1 M pH 7.4 potassium phosphate buffer) into the system the chip was exposed to a buffer of the same pH. For the bare sensor the measurement was similar as the TMV modified gold sensor.



Supplementary fig. 1 Representative AFM micrographs showing the stability of TMV substrate after 24 hours incubation. (A) Silane wafer coated with 3 µg/cm² TMV nanoparticles. Left: the wafer is completely covered with multilayers of TMV (scan area is 10 µm). Right: the morphology of rod-shape virus is visible (scan area is 2 µm). (B) TMV-coated wafer after 24 hours incubation in PBS at 37 °C. Left: the wafer is still completely covered with a few layers of TMV (scan area is 10 µm). Right: the rod-shape virus is still visible showing intact viral particles on the substrate.



Supplementary fig. 2 RT-qPCR analysis for *BMP2* expression in the cells seeded on TCP control with or without the three osteogenic inducers for 8 hours. The osteogenic inducers are sodium β-glycerolphosphate, L-ascorbic acid 2-phosphate and dexamethasone. No significant difference in *BMP2* gene expression was observed. The error bars denote ± s.d.



Supplementary fig. 3 QCM-D results showing changes in the third harmonic frequency (Δf) and dissipation (ΔD) when delivering (A) 10 mM of sodium β-glycerolphosphate, (B) 10 nM of dexamethasone, (C) 50 µg/mL of ascorbic acid-2-phosphate to TMV-coated gold surface, and when delivering (D) 10 mM of sodium β-glycerolphosphate, (E) 10 nM of dexamethasone, (F) 50 µg/mL of ascorbic acid-2-phosphate to uncoated gold surface. No significant deposition can be seen at all conditions.

Gene	Sequence (5'-3')
ALPL	Forward: ACCTCGAGCAGGAACAGAAGTTGCT
	Reverse: TTCCATGATGGTTGCAGGGTCTGGA
BMP2	Forward: ACCAACCATGGGTTTGTGGTGGGAAGT
	Reverse: TCCGCTGTTTGIGTTTGGCTTGACG
GAPDH	Forward: ACTAAAGGGCATCCTGGGCTACACTGA
	Reverse: TGGGTGGTCCAGGGTTTCTTACTCCTT
IBSP	Forward: TCTGAACGGGTTTCAGCAGACGA
	Reverse: GCCATGCCCTTGTAGTAGCTGTA

Supplementary fig. 4 Primers used for RT-qPCR to measure gene expression levels. ALPL: alkaline phosphatase; BMP2: bone morphogenetic protein 2; IBSP: integrin-binding sialoprotein.