

Supporting Information

Bioactive powder adhesive featuring clotting synergy for alveolar extraction socket hemostasis and regeneration

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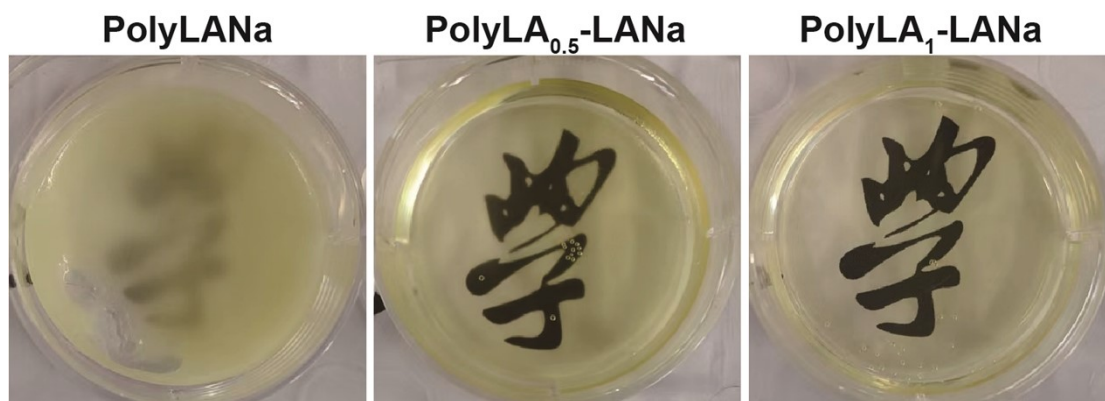


Figure S1. Representative photographs of dry PolyLANa, dry PolyLA_{0.5}-LANa, and dry PolyLA₁-LANa.

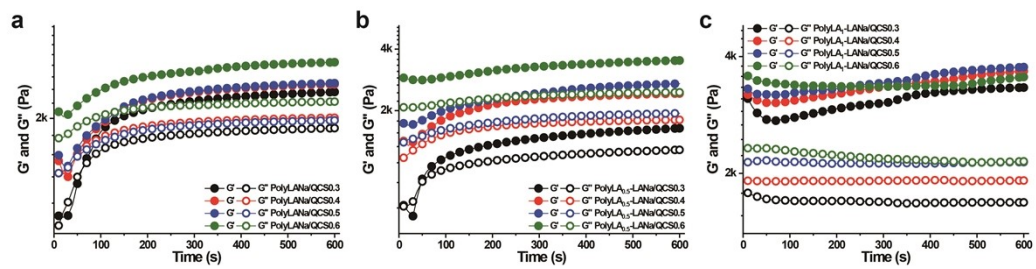


Figure S2. Rheological time sweep curves of the PolyLANa/QCSy (a), PolyLA_{0.5}-LANa/QCSy (b), and PolyLA₁-LANa/QCSy (c) composite powders.

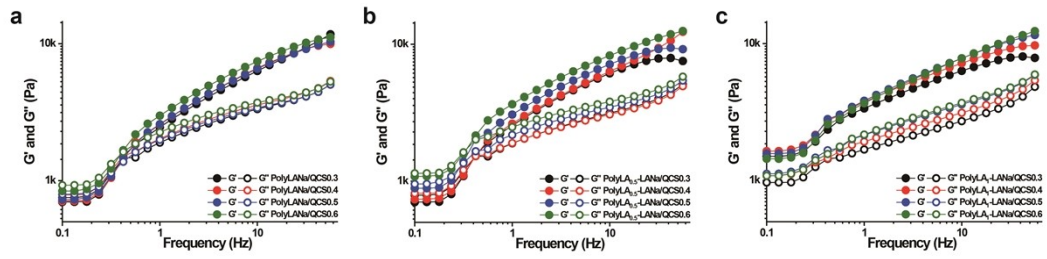


Figure S3. Rheological frequency sweep curves of the PolyLANa/QCSy (a), PolyLA_{0.5}-LANa/QCSy (b), and PolyLA₁-LANa/QCSy (c) composite powders.

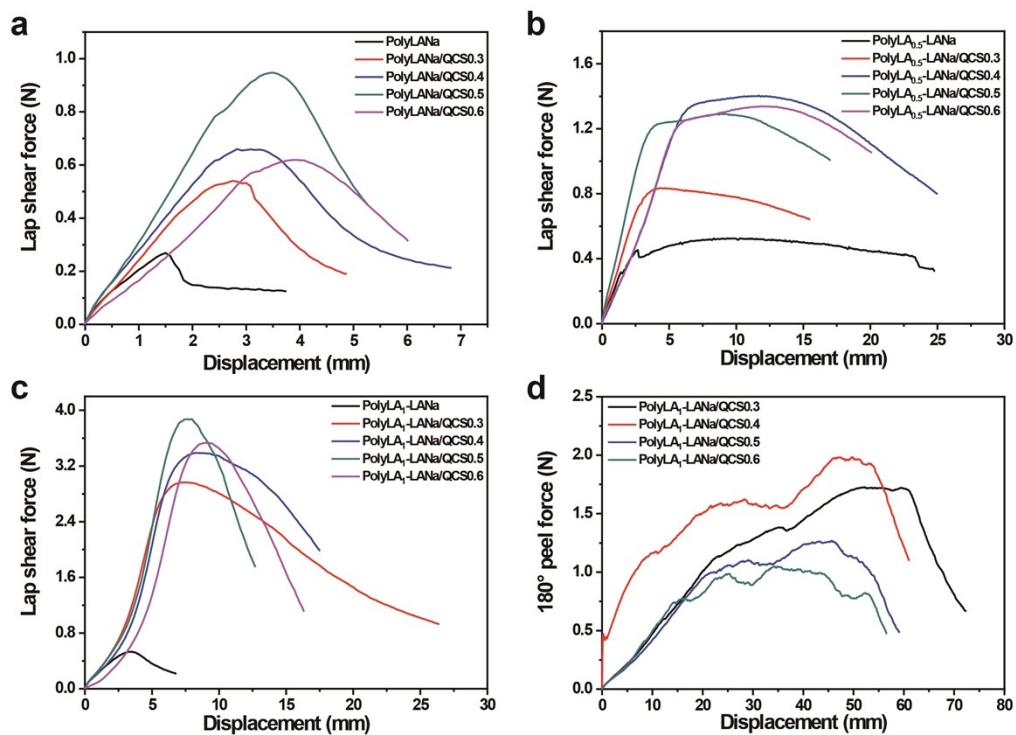


Figure S4. (a-c) Lap shear force-displacement curves obtained during lap shear testing on wet porcine skin for PolyLANa and PolyLANa/QCSy (a), PolyLA_{0.5}-LANa and PolyLA_{0.5}-LANa/QCSy (b), and PolyLA₁-LANa and PolyLA₁-LANa/QCSy (c); (d) 180° peel force-displacement curves of PolyLA₁-LANa/QCSy on wet porcine skin for the evaluation of interface toughness.

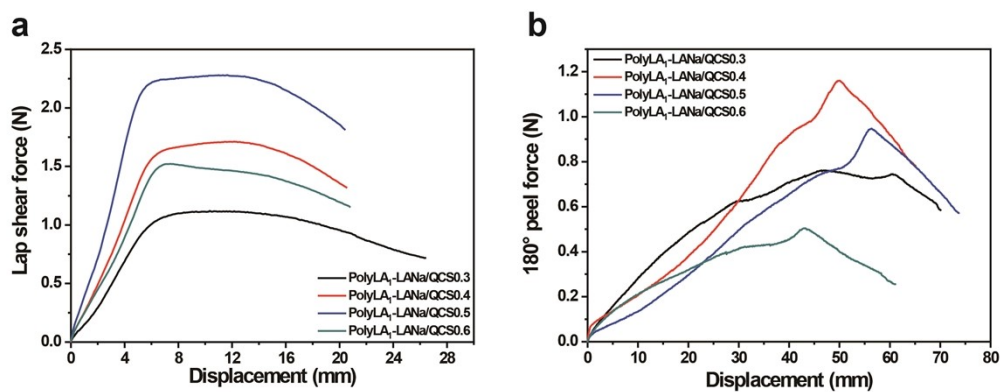


Figure S5. (a) Lap shear force-displacement curves obtained during lap shear testing on blood-covered porcine skin for PolyLA₁-LANa/QCSy; (b) 180° peel force-displacement curves of PolyLA₁-LANa/QCSy on blood-covered porcine skin for the evaluation of interface toughness.

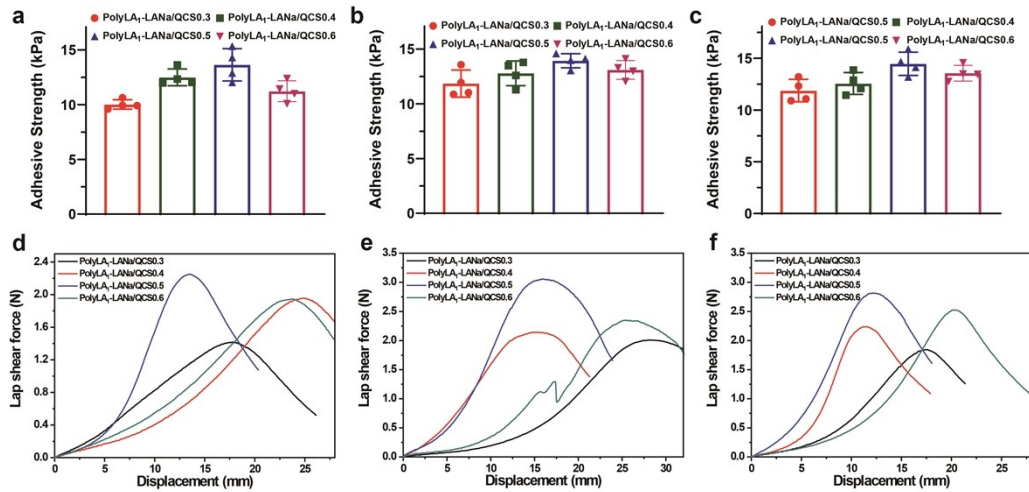


Figure S6. (a-c) Adhesive strength of the PolyLA₁-LANa/QCS_y composite powders evaluated in a wet environment on diverse biological surfaces: stomach (a), muscle (b), and heart muscle (c) ($n = 4$); (d-f) Lap shear force-displacement curves obtained during the tensile testing corresponding to the adhesion on the stomach (d), muscle (e), and heart muscle (f) for PolyLA₁-LANa/QCS_y.

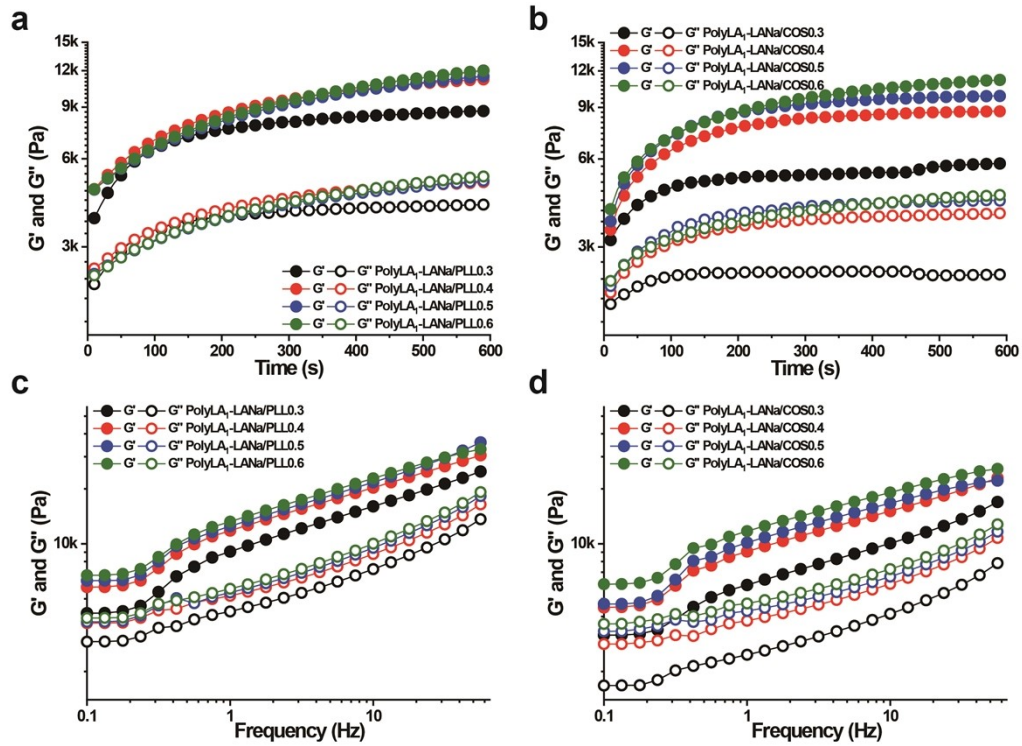


Figure S7. Rheological time sweep curves of PolyLA₁-LANa/PLL and PolyLA₁-LANa/COS composite powders (a, b); Rheological frequency sweep curves of PolyLA₁-LANa/PLL and PolyLA₁-LANa/COS composite powders (c, d)

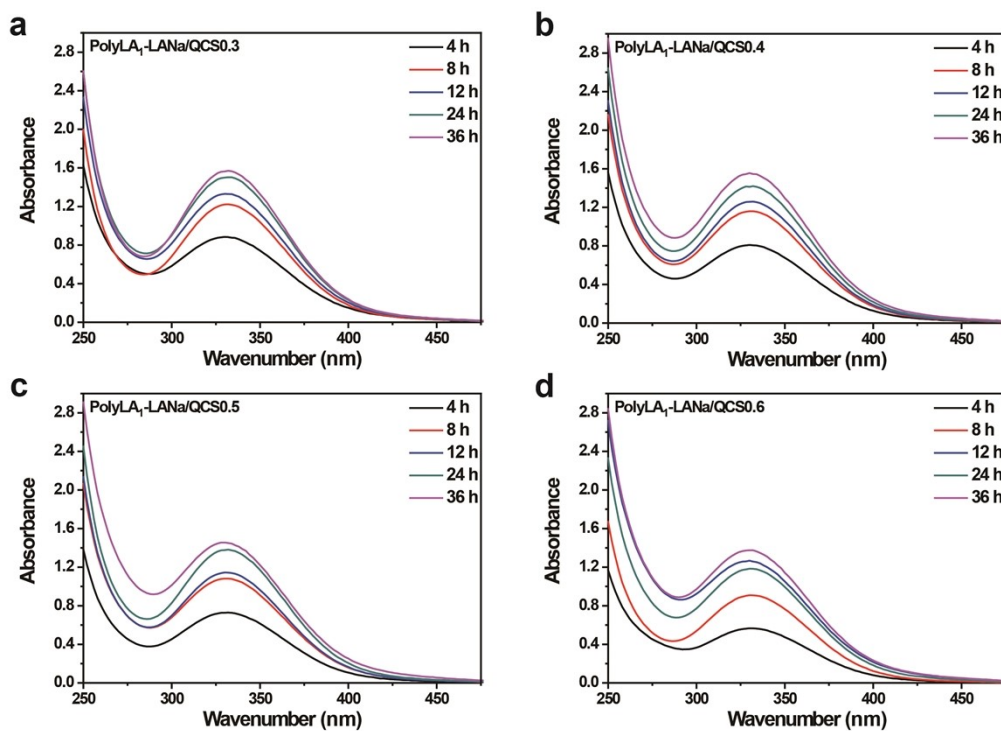


Figure S8. (a-d) UV-Vis absorbance spectra recorded from PolyLA₁-LANa/QCSy with different compositions at specific time intervals (4, 8, 12, 24, and 36 h) in an aqueous environment to evaluate the *in vitro* release kinetics of LANa monomers from the composite powders.

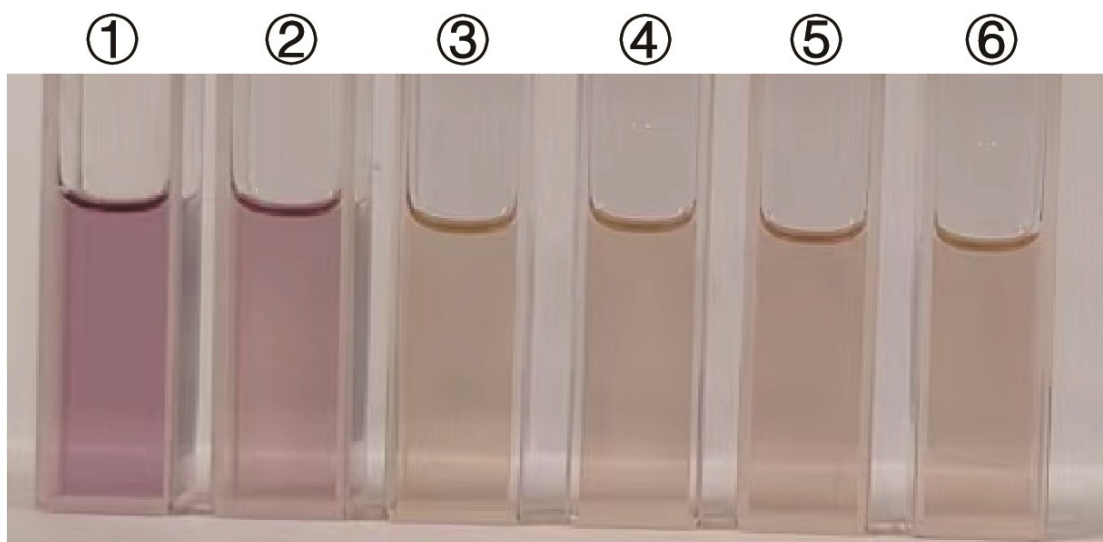


Figure S9. Macroscopic colorimetric visualization of the DPPH radical clearance assay for pure QCS and PolyLA₁-LANa/QCSy composite powders. The photograph illustrates the visual color transitions of the DPPH solutions after incubation with the corresponding samples. From left to right: ① Control; ② Pure QCS; ③ PolyLA₁-LANa/QCS0.3; ④ PolyLA₁-LANa/QCS0.4; ⑤ PolyLA₁-LANa/QCS0.5 and ⑥ PolyLA₁-LANa/QCS0.6.

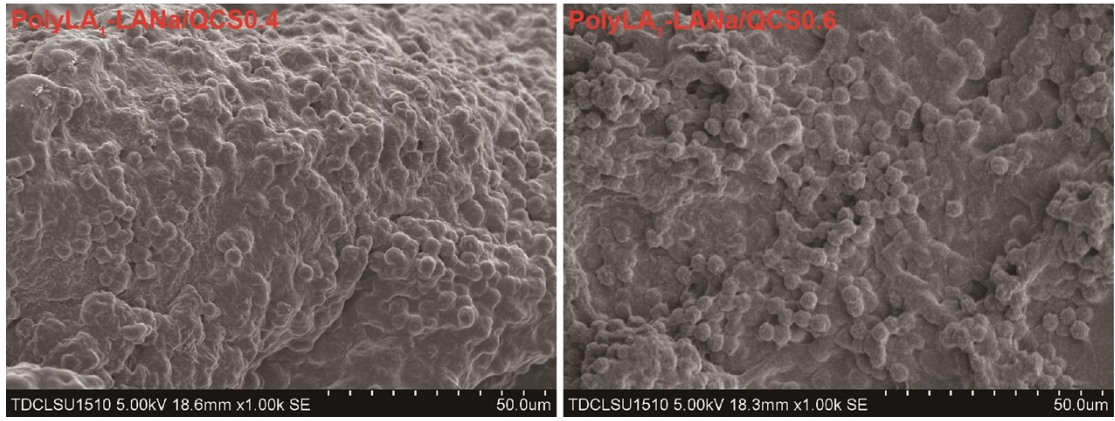


Figure S10. SEM images illustrating the aggregation and characteristic morphology of RBCs adhered to PolyLA₁-LANa/QCS0.4 and PolyLA₁-LANa/QCS0.6 (Scale bars: 50 μ m).

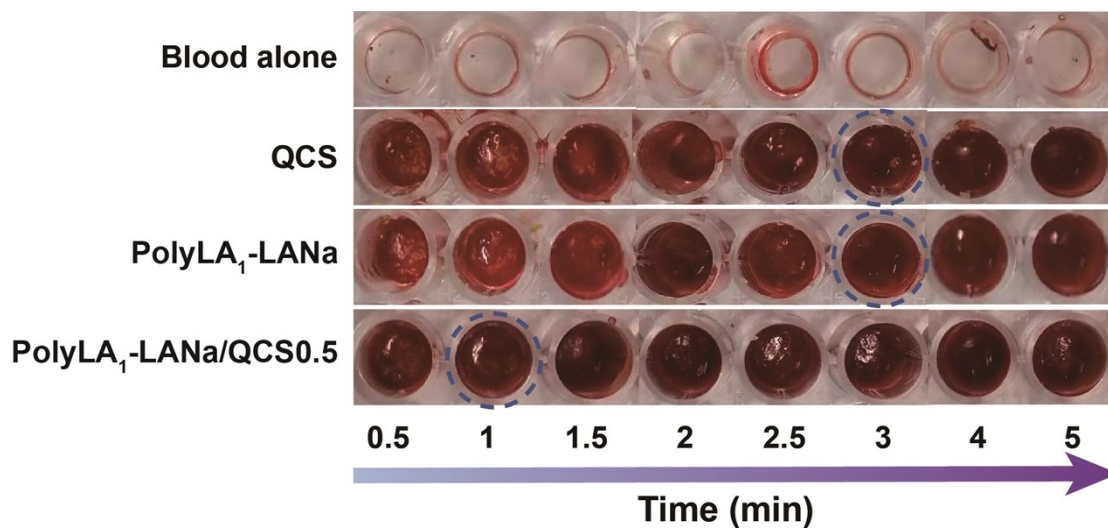


Figure S11. Macroscopic observation of the in vitro whole blood clotting time assay. Representative photograph illustrates the dynamic blood clotting process over a 5-minute period. The image compares the visual clotting status of the blood alone (blank control), pure QCS, PolyLA₁-LANa, and PolyLA₁-LANa/QCS0.5 composite powder at specific time intervals.

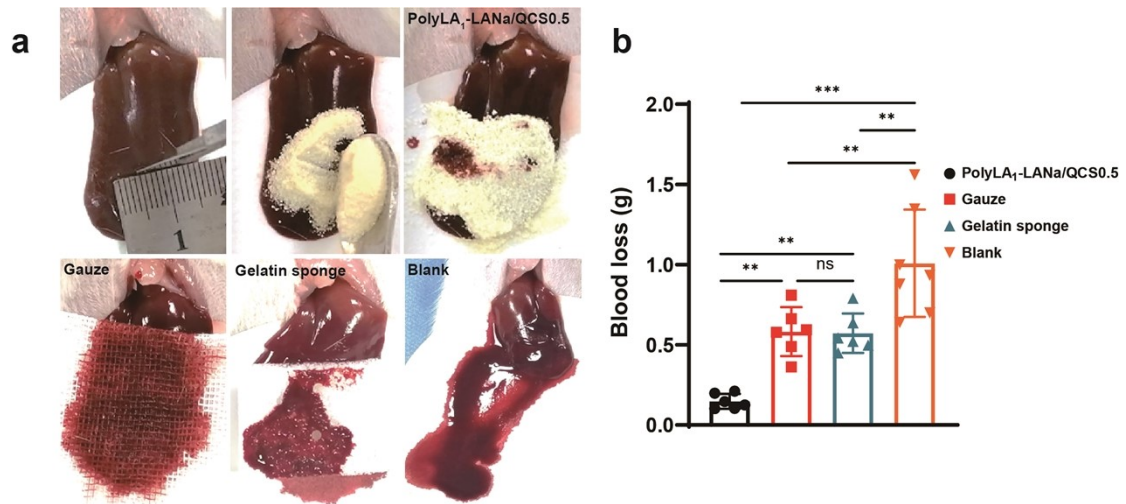


Figure S12. (a) Macroscopic photographs illustrating the hemostatic treatment of a rat liver injury model using commercial gauze, gelatin sponge, and PolyLA₁-LANa/QCS0.5 composite powder; (b) Quantitative analysis of total blood loss in a rat liver injury model ($n = 6, 7$) (** $p < 0.01$, *** $p < 0.001$ and "ns" denotes no significant difference).

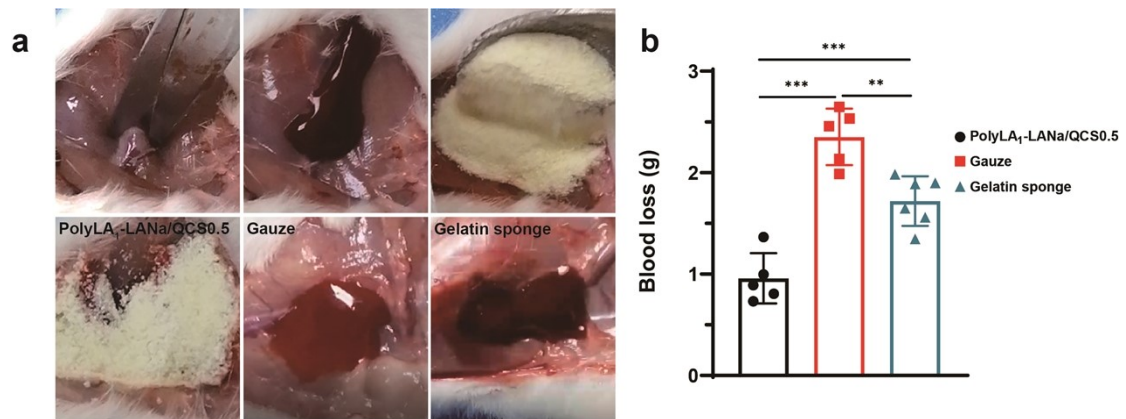


Figure S13. (a) Macroscopic photographs illustrating the hemostatic treatment of a rat muscle and blood vessel injury model using commercial gauze, gelatin sponge, and PolyLA₁-LANa/QCS0.5 composite powder; (b) Quantitative analysis of total blood loss in a rabbit muscle and blood vessel injury model ($n = 6$) (** $p < 0.01$, *** $p < 0.001$).

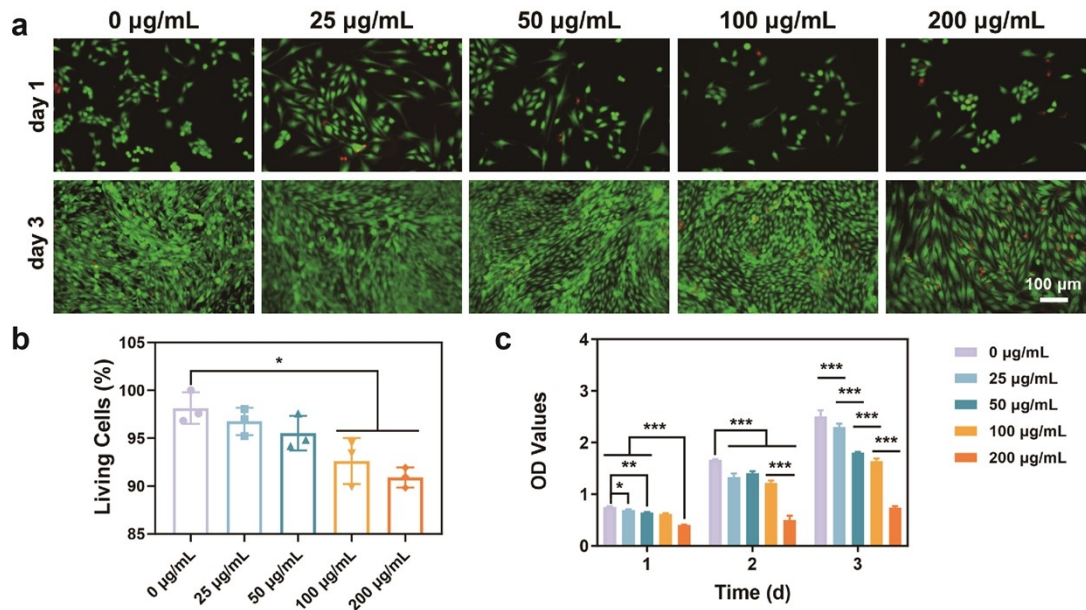


Figure S14. (a) Live/Dead staining images and the proportion of living cells of MC3T3-E1 cells co-cultured with PolyLA₁-LANa/QCS0.5 for 1 and 3 days; (b) Cell viability of MC3T3-E1 cells co-cultured with PolyLA₁-LANa/QCS0.5 for 1 and 3 days; (c) OD values of MC3T3-E1 cells co-cultured with PolyLA₁-LANa/QCS0.5 for 1 and 3 days (* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$).

Video S1. Rat femoral artery puncture model—PolyLA₁-LANa/QCS0.5

Video S2. Rat femoral artery puncture model—Gelatin sponge

Video S3. Rat femoral artery puncture model—Gauze

Video S4. Rat muscle and blood vessel injure model—PolyLA₁-LANa/QCS0.5

Video S5. Rat muscle and blood vessel injure model—Gelatin sponge

Video S6. Rat muscle and blood vessel injure model—Gauze

Video S7. PolyLA₁-LANa/QCS0.5 tightly seals the bleeding site after hemostasis

Video S8. Rabbit femoral artery puncture model—PolyLA₁-LANa/QCS0.5

Video S9. Rabbit femoral artery puncture model—Gelatin sponge

Video S10. Rabbit femoral artery puncture model—Gauze