

Supplementary information for

Xiaolan Li, Yuanyuan Zhou, Yu Deng, Rui Chen, Li Xue, Yuxin Li, Mengyuan Wang, Jie Weng, Huan Tan, 2026. 3D-printed biochemical–biomechanical gradient scaffolds from high internal phase Pickering emulsion with dual gelatin-modulated gelling kinetics for enhanced osteochondral regeneration. *Bio-Des Manuf*, early access.

<https://doi.org/10.1631/bdm.2600089>

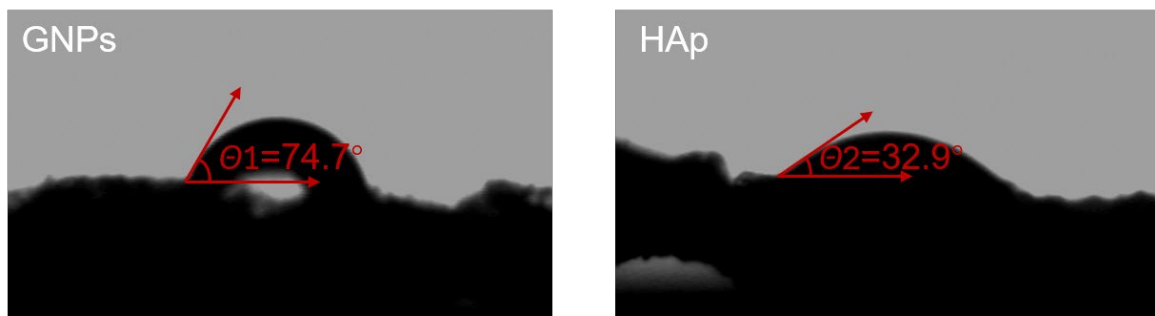


Fig. S1 Water contact angles of GNPs and HAp.

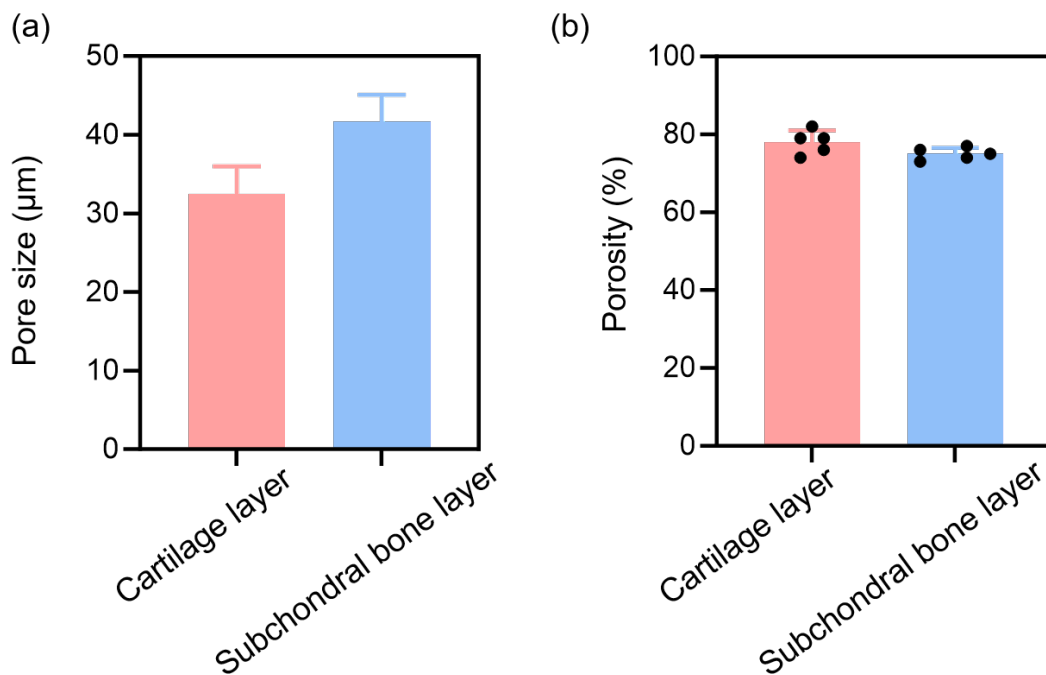


Fig. S2 Quantitative pore size distribution (a) and porosity (b) of the scaffolds.

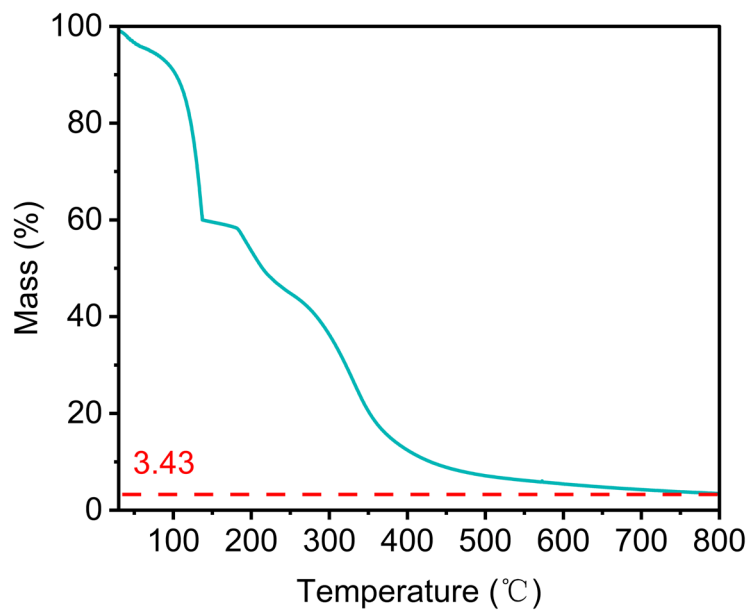


Fig. S3 Thermogravimetric analysis (TGA) of the subchondral bone layer scaffold.

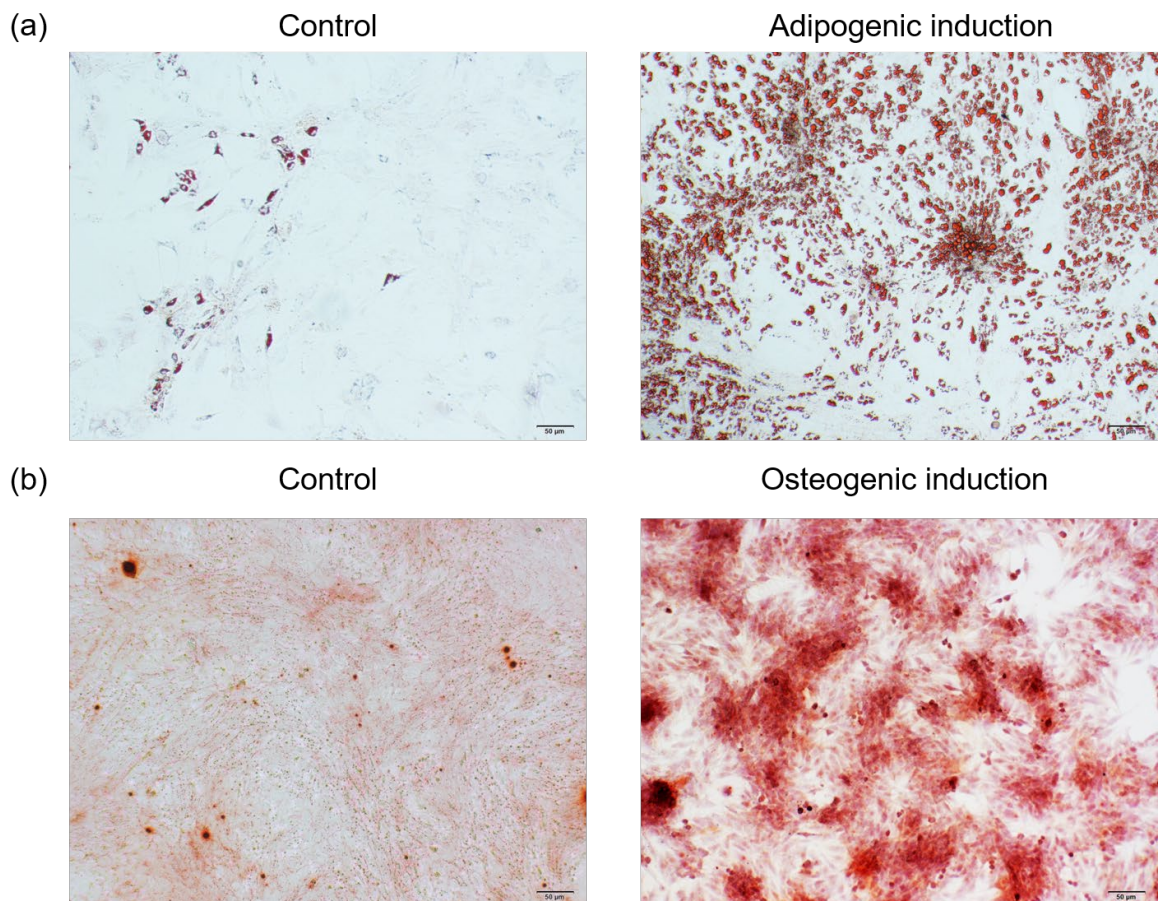


Fig. S4 Multilineage differentiation potential of BMSCs. (a) Adipogenic induction. (b) Osteogenic induction.

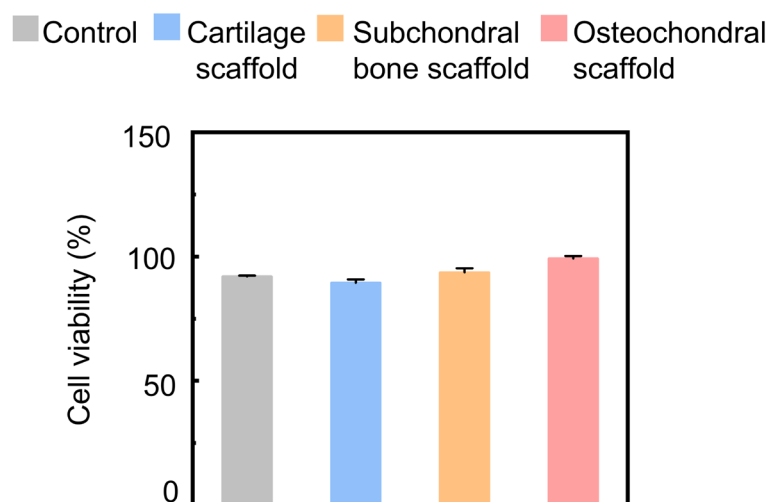


Fig. S5 Cell viability of BMSCs on different scaffolds. Data are shown as mean $\pm$ standard deviation, $n=3$

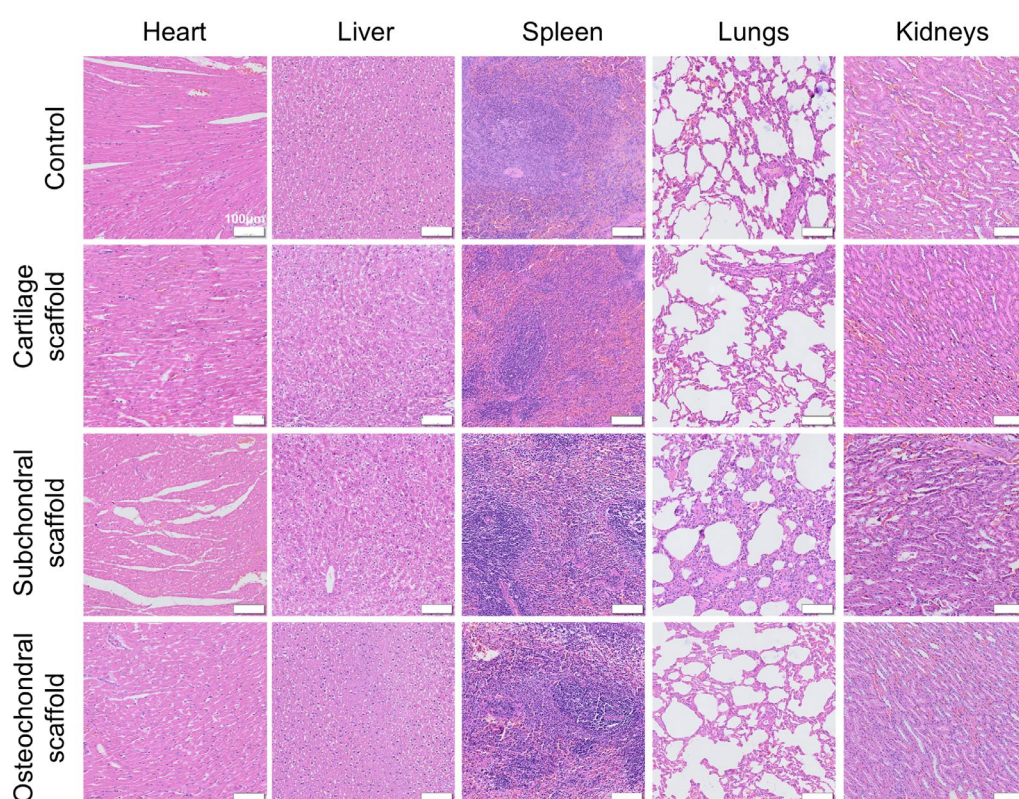


Fig. S6 H&E-stained images of rat vital organ samples from different groups, respectively. Scale bar: 100 μ m

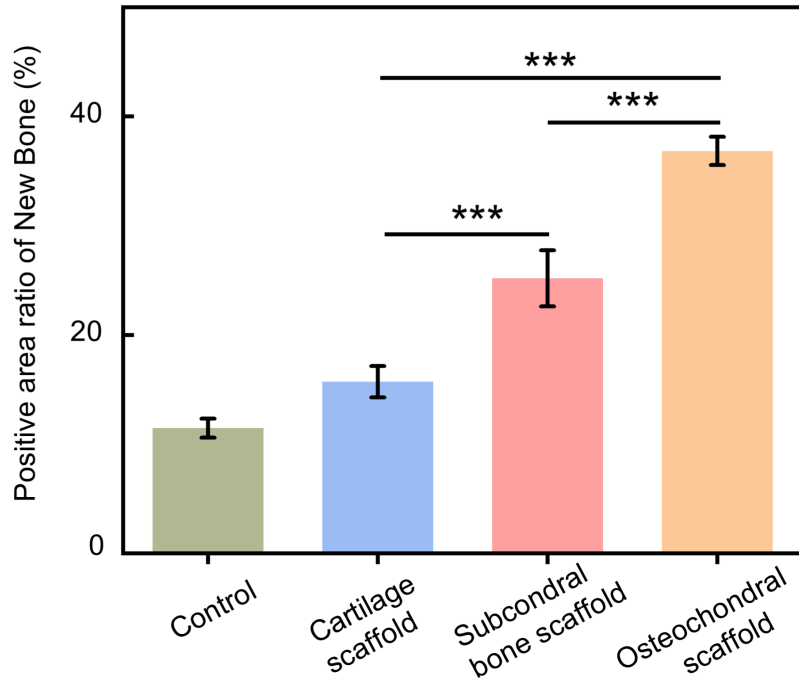


Fig. S7 Quantitative analysis of the new bone (%). Data are shown as mean±standard deviation, $n=3$. *** $P<0.001$

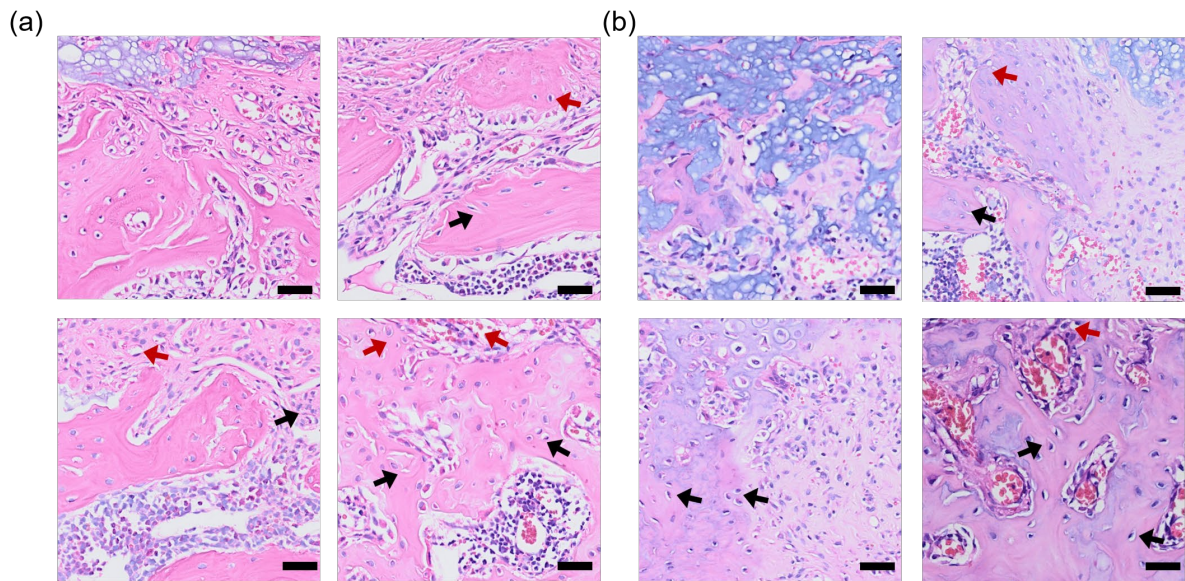


Fig. S8 Higher-magnification H&E images of regenerated tissues in the osteochondral scaffold group at 4 weeks (a) and 8 weeks (b). Red arrows: chondrocytes. Black arrows: osteoblasts. Scale bars: 25 μm

Table S1 The sequences of RNA primers used in this study

Genes	Primer sequences
Mouse species	
COL1A1	Forward: 5'- GCTCCTCTTAGGGGCCACT -3' Reverse: 5'- ATTGGGGACCCTTAGGCCAT -3'
COL2A1	Forward: 5'- TGGACGATCAGGCGAAACC -3' Reverse: 5'- GCTGCGGATGCTCTCAATCT -3'
SOX9	Forward: 5'- AGCGAACGCACATCAAGAC -3' Reverse: 5'- CTGTAGGCGATCTGTTGGGG -3'
RUNX2	Forward: 5'- GACTGTGGTTACCGTCATGGC -3' Reverse: 5'- ACTTGGTTTTTCATAACAGCGGA -3'
OCN	Forward: 5'- CTGACCTCACAGATCCCAAGC -3' Reverse: 5'- TGGTCTGATAGCTCGTCACAAG -3'