3D bio-printing of photocrosslinkable anatomically tooth shaped scaffolds for alveolar ridge preservation after tooth extraction

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1. Characterization of NPP composites and scaffolds

Figure S1. SEM micrographs of NPP scaffolds without SBF immersion. (A) NPP-0% scaffold, (B) NPP-5% scaffold, (C) NPP-10% scaffold.

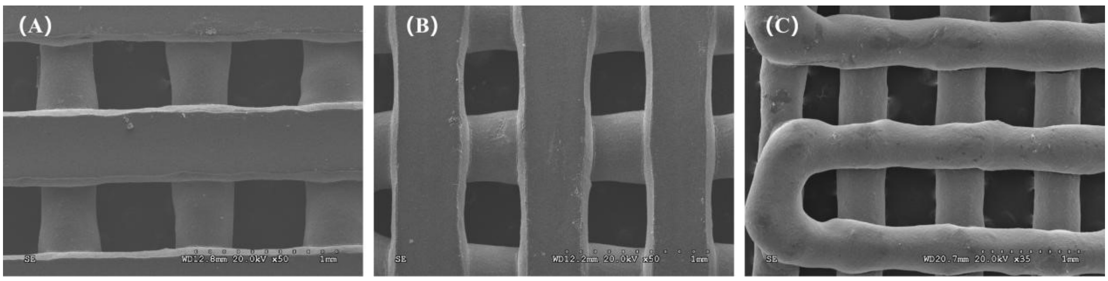
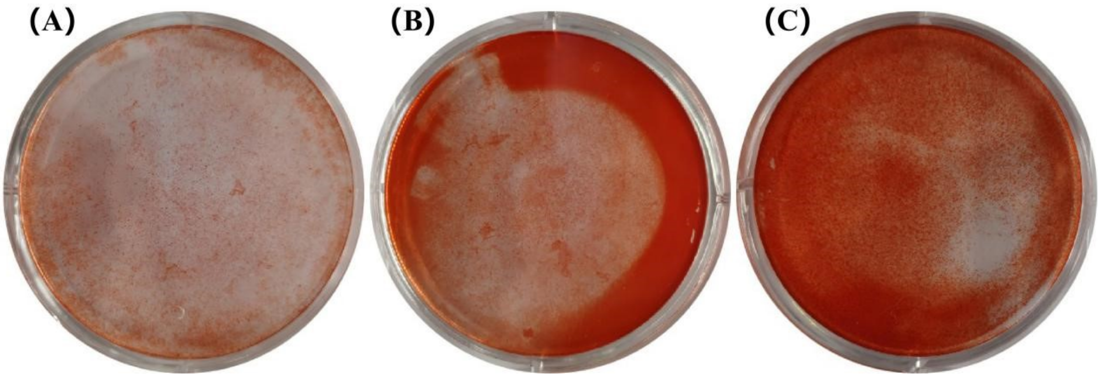


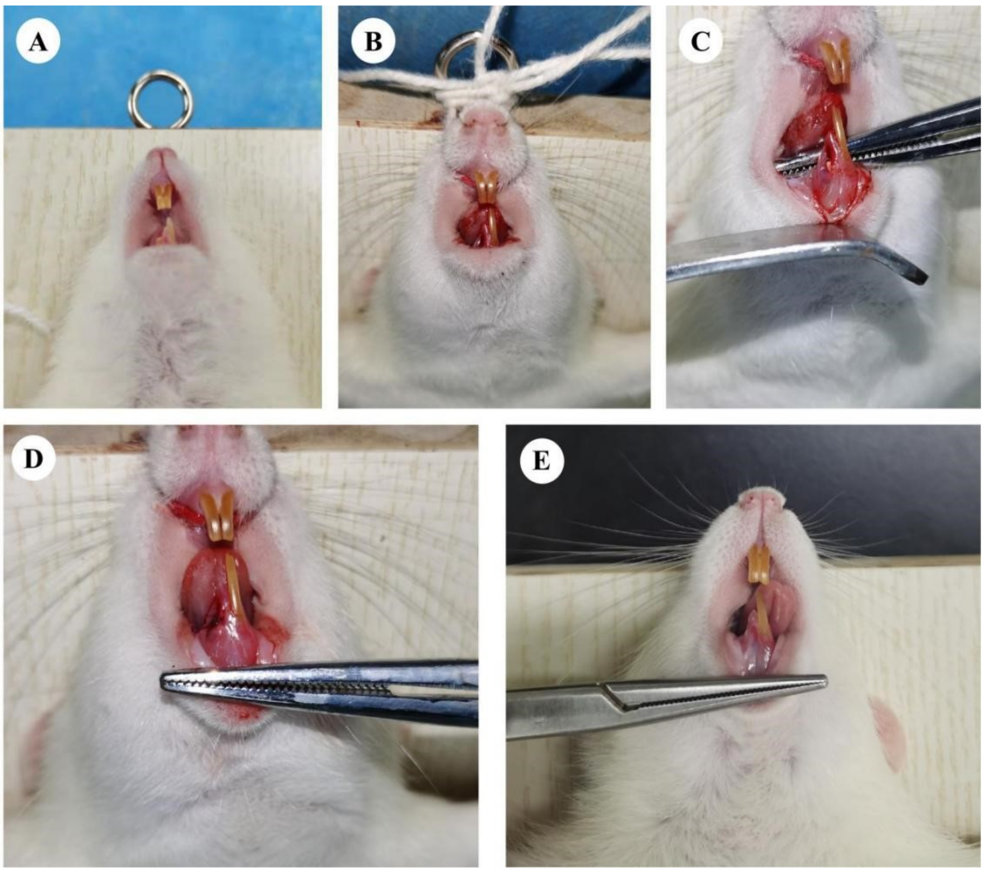
Figure S2. The scanning images of alizarin red staining (ARS) for 14 days. (A) Blank, (B) NPP-0% scaffold, (C) NPP-5% scaffold.



(In order to avoid the influence of the calcium ions in the powdered nacre, the ARS assay was carried out by culturing cells in the extracted liquid, approximately 1 g of the scaffolds from each group was immersed in 10 mL of osteoinductive media)

Figure S3. Establishment and scaffold implantation of tooth extraction model in rat

(A) Mandibular right incisor was grinded off at the level of the gums, (B) tooth extraction, (C) NPP scaffolds grafted, (D) gingival tissue sutured, (E) healing of soft tissue at 6 weeks.



2. Fabrication of nacre/PU (NP) composites and scaffolds

NP composites containing different ratios of powdered nacre were prepared before POSS added. Three groups of NP composites were synthesized as follows:

40% nacre: 40 wt% nacre + 60 wt% PU + 10 wt% WSM

50% nacre: 50 wt% nacre + 50 wt% PU + 10 wt% WSM

60% nacre: 60 wt% nacre + 40 wt% PU + 10 wt% WSM

Figure S4. Water contact angle measurements of different NP composites. (A) Image of contact angle measurement, (B) the hydrophilia of NP composites ($^{*}p < 0.05$, $^{**}p < 0.01$).

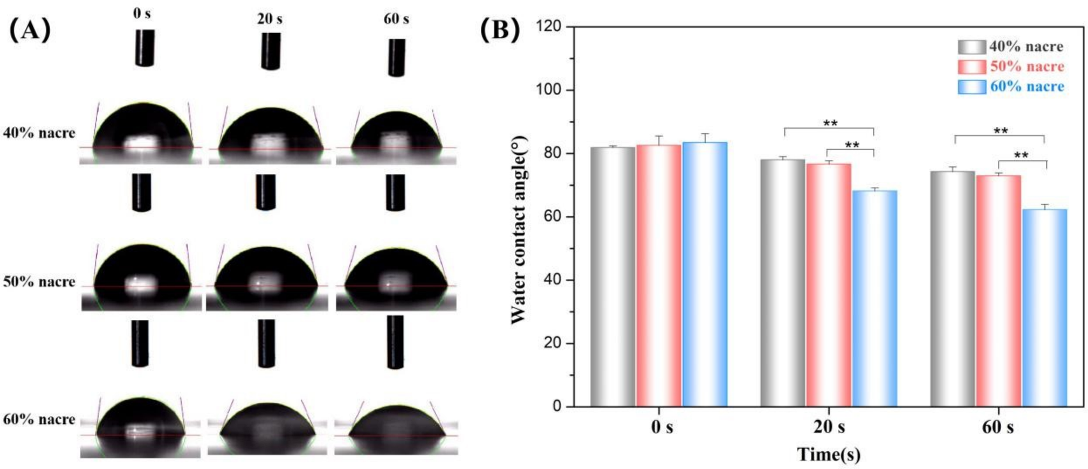


Figure S5. The viscosity versus shear rate profile of different NP composites

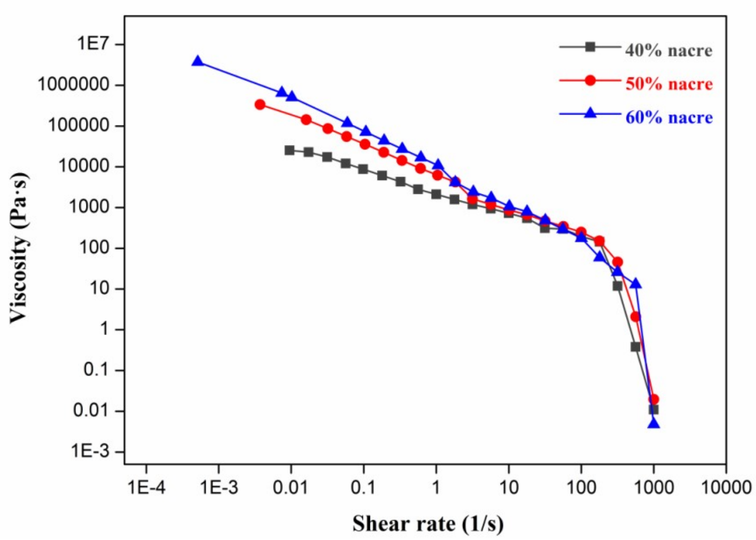
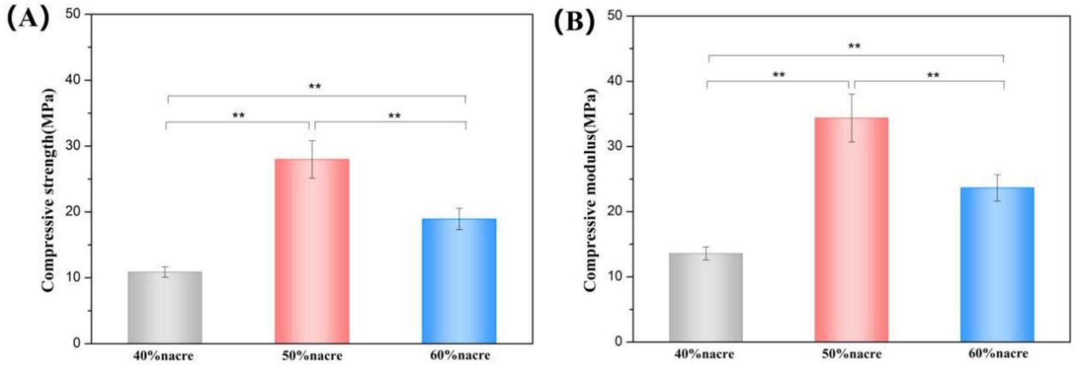


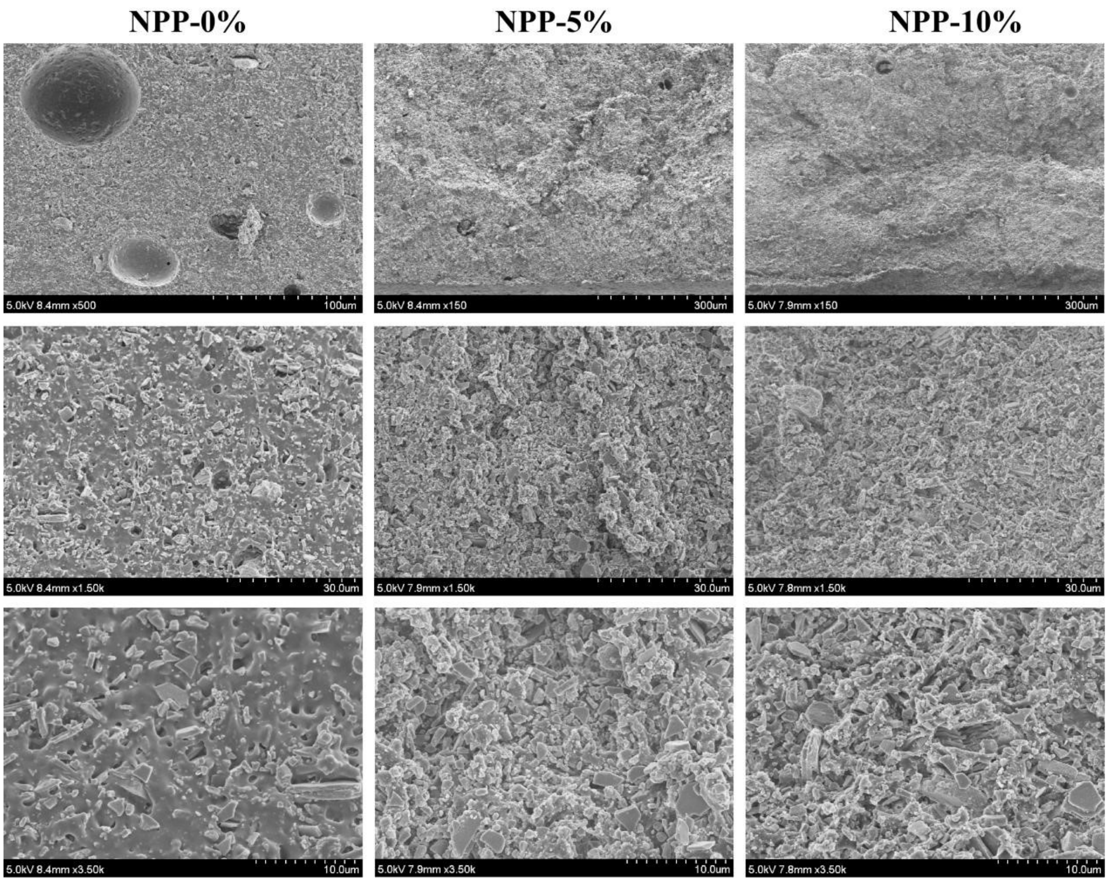
Figure S6. The compressive properties of different NP composite scaffolds. (A) compressive strength, (B) compressive modulus ($^{**}p < 0.01$).



Following the properties tests screening, comprehensive consideration of the wettability, mechanical properties, rheology and printability properties, 50% nacre group was selected for the next experiment to evaluate the effect of POSS addition.

3. The SEM analysis of NPP composites in section

Figure S7. The SEM analysis of NPP composites in section



The distribution of nacre in PU and PU/POSS matrix was investigated. SEM images showed that the distribution of nacre in PU matrix (NPP-0% group) was uneven, which may due to the higher viscosity of PU. It can be seen that the fracture surface became rough in the NPP-5% and NPP-10% group, which exhibited low viscosity compared with NPP-0% group and the nacre dispersion is uniform. This good interaction with polymer blend also endows the composites with good mechanical properties.

Figure S8. The size of the 3D printing scaffolds for alveolar ridge preservation after tooth extraction in rat

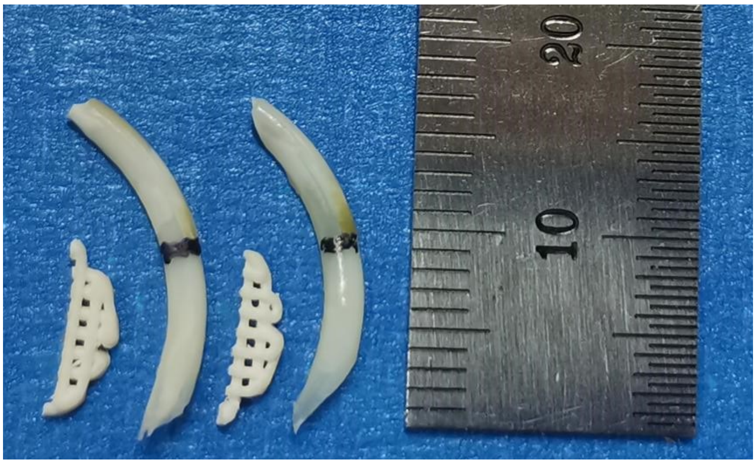


Table S1 Primer sequences for qPCR

Target gene	Forward primer sequence (5' –3')	Reverse primer sequence (5' –3')
GAPDH	TGGACTTCGAGCAAGAGATGG	ATCTCCTTCTGCATCCTGTCG
ALP	GCCCTCTCCAAGACATATA	CCATGATCACGTCGATATCC