Supporting information for

A Simple Hydrogel Scaffold with Injectability, Adhesivity and Osteogenic Activity for Bone Regeneration

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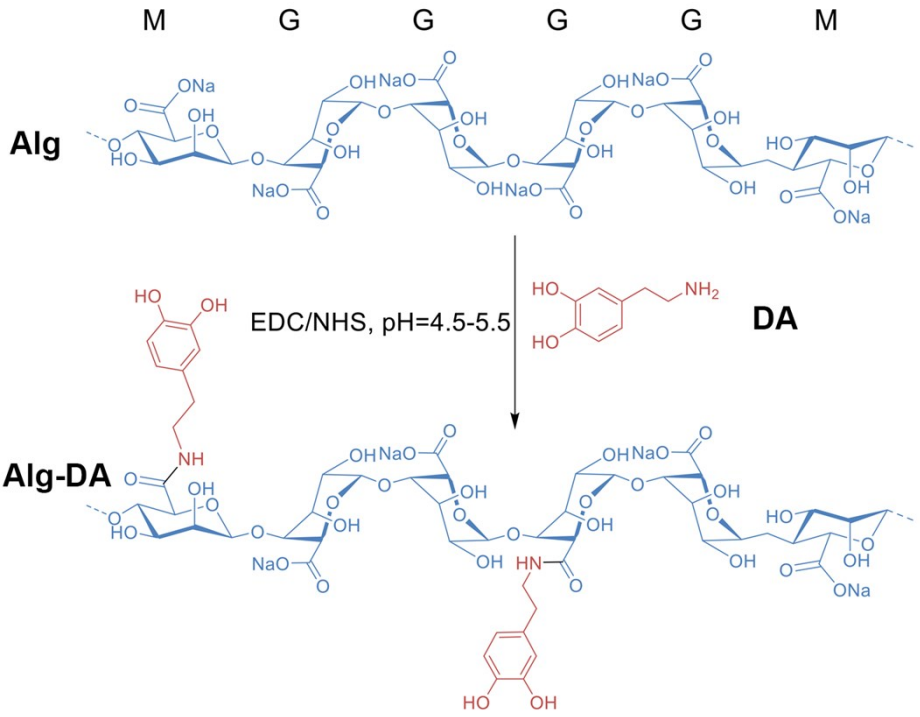

Figure S1. Synthesis of Alg-DA conjugates by ligating DA to Alg using EDC/NHS chemistry.

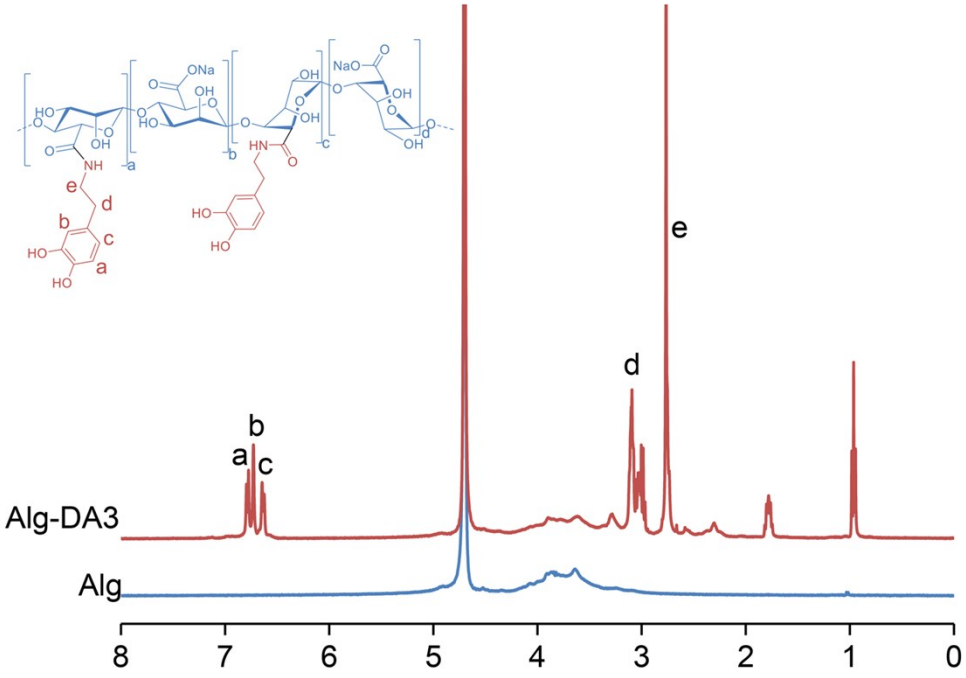

Figure S2. ^{1}H NMR spectra of Alg and Alg-DA3 in D_2O.

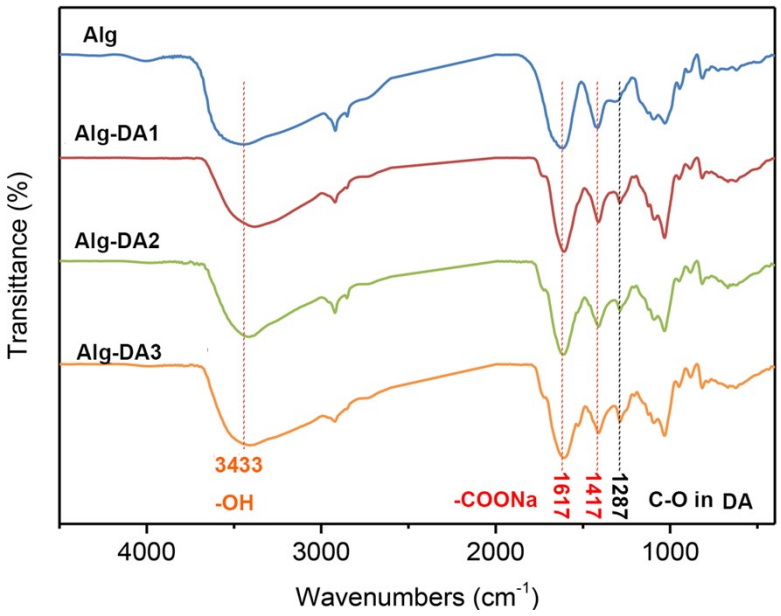

Figure S3. FTIR spectra of Alg and Alg-DA conjugates.

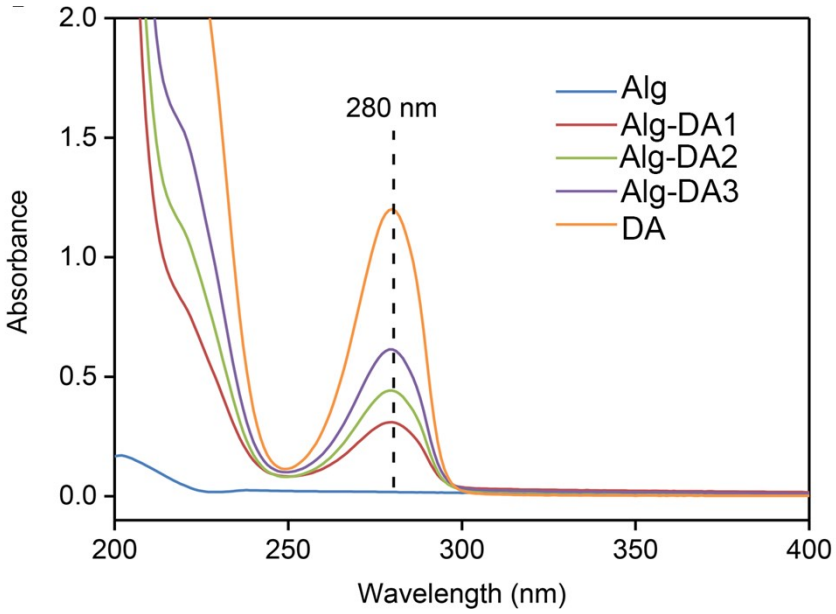

Figure S4. UV-vis spectra of Alg, DA and Alg-DA conjugates with different degrees of substitution, the concentration of all samples is 160 μg/L.

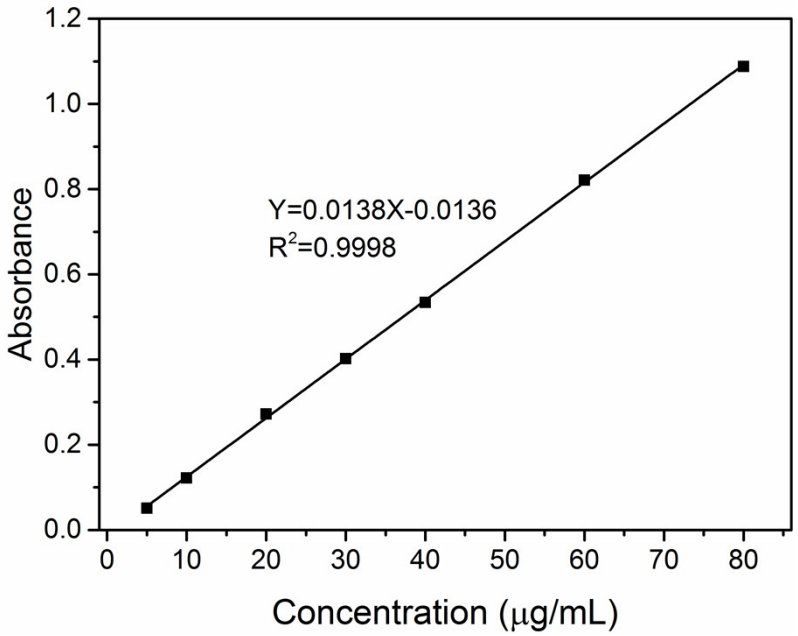

Figure S5. The standard curve of DA determined by UV-vis spectra.

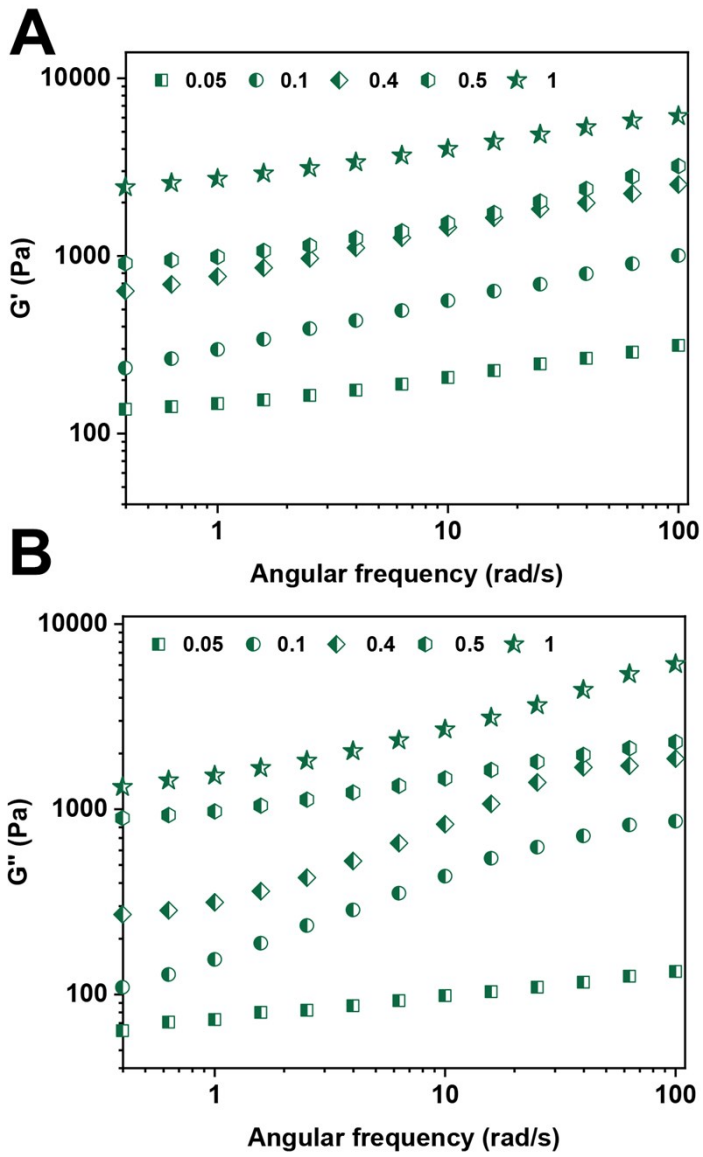

Figure S6. The viscoelastic moduli of Alg-DA/Sr^{2+} SC hydrogel: (A) The storage modulus; (B) The loss modulus. Dynamic oscillatory frequency sweeps at 0.5% strain with the different molar ratio of [Sr^{2+}] to [COONa] in Alg-DA. [Sr^{2+}]:[COONa]=0.05, 0.1, 0.4, 0.5, 1, respectively.

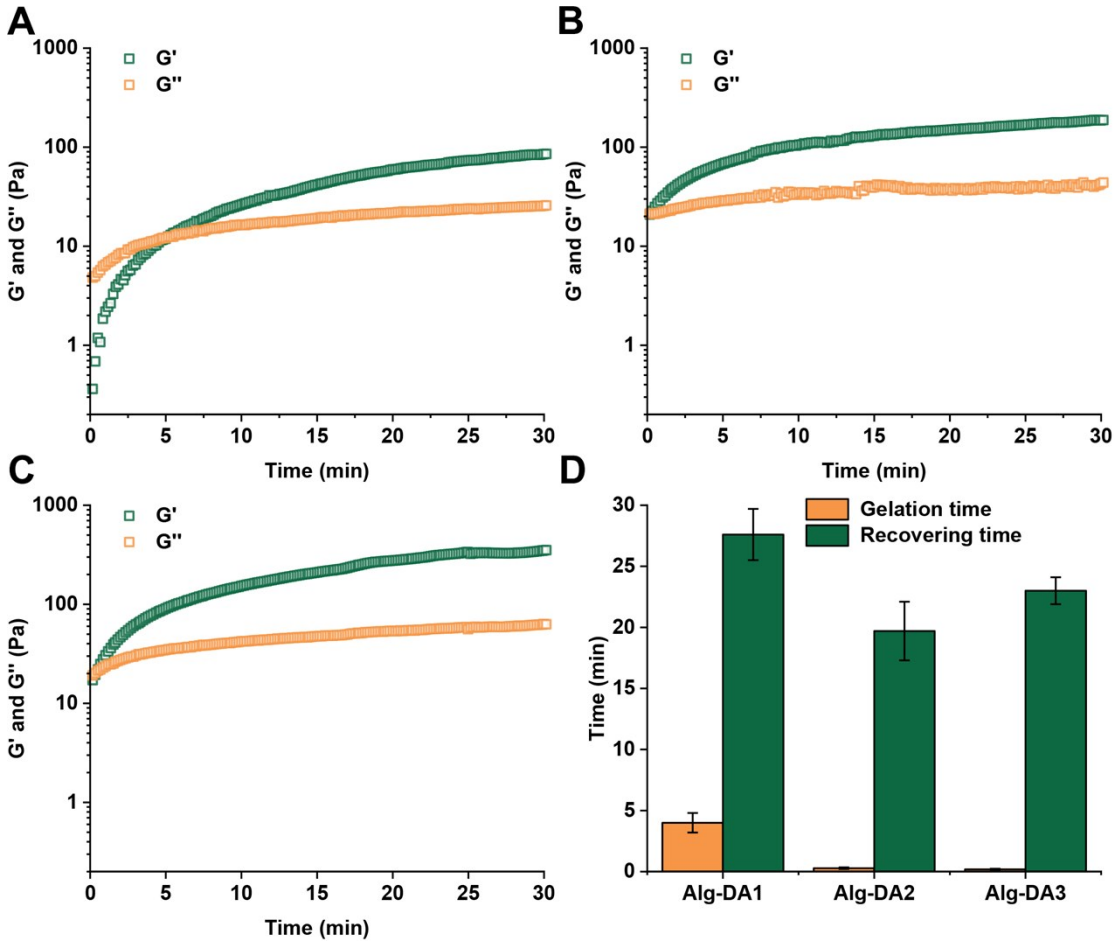

Figure S7. Storage modulus (G') and loss modulus (G'') of Alg-DA/Sr^{2+} SC hydrogel after injecting: (A) Alg-DA1; (B) Alg-DA2; (C) Alg-DA3, (D) Gelation time and recovering time of hydrogels. All measurements were performed at a frequency of 10 rad/s and a strain of 0.5% with [Sr^{2+}]/[COONa] = 0.05.

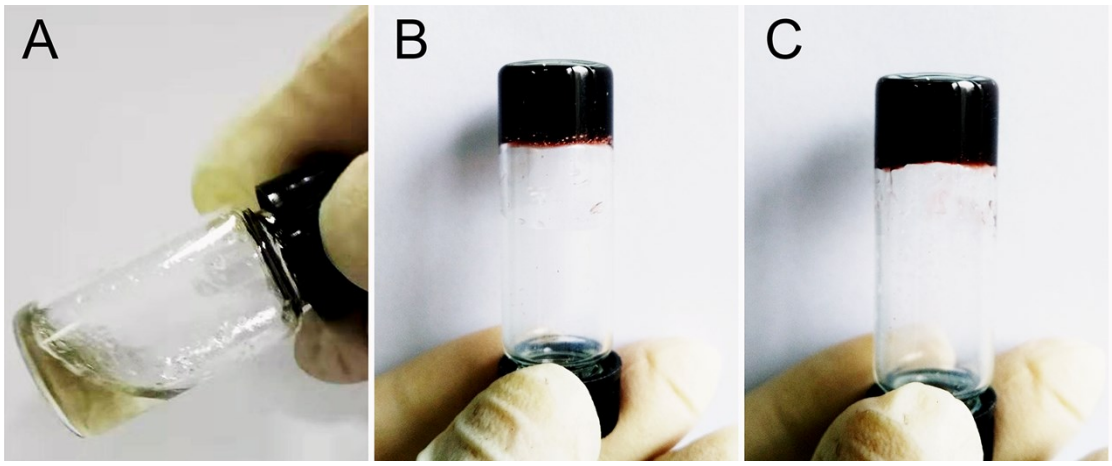

Figure S8. (A) Alg-DA solution, (B) Alg-DA SC hydrogel, (C) Alg-DA/Sr^{2+} DC hydrogel. [Alg-DA2] = 4 wt%, [Sr^{2+}]/[COONa]= 0.05, [HRP] = 25 U/mL, [H_2O_2] = 50 mM.

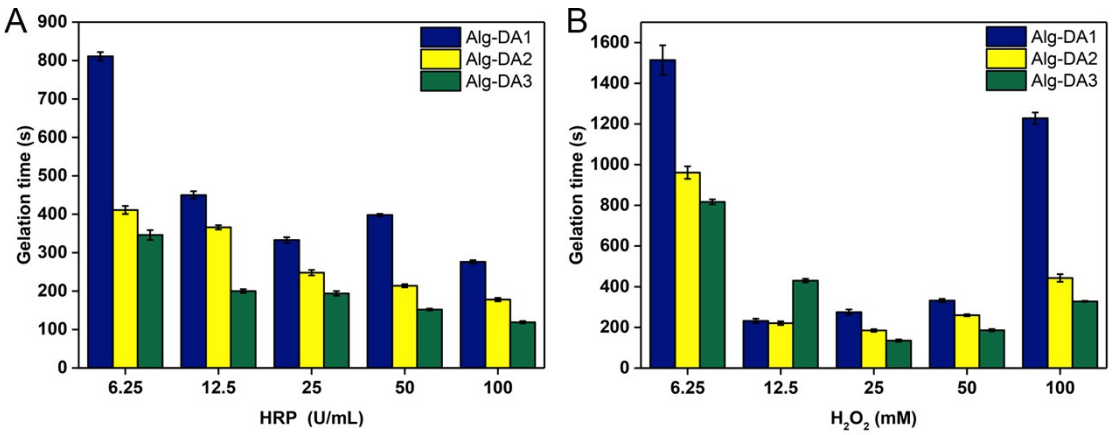

Figure S9. (A) Influence of [H_2O_2] on gelation time. [Alg-DA] = 4 wt%, [HRP] = 25 U/mL. (B) Influence of [HRP] on gelation time. [Alg-DA] = 4 wt%, [H_2O_2] = 50 mM.

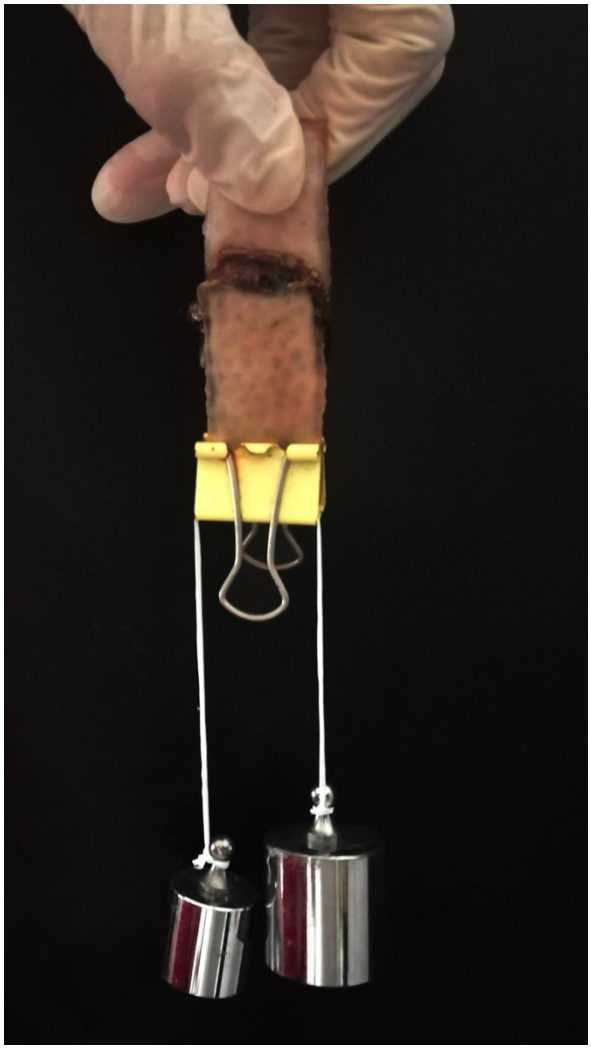

Figure S10. Photographic illustration of lap-shear testing using two wet porcine skin tissues bonded with Alg-DA/Sr^{2+} DC hydrogel (Contact area: 2.5 cm×2 cm; Weight: 150g; Load: 3 kPa).

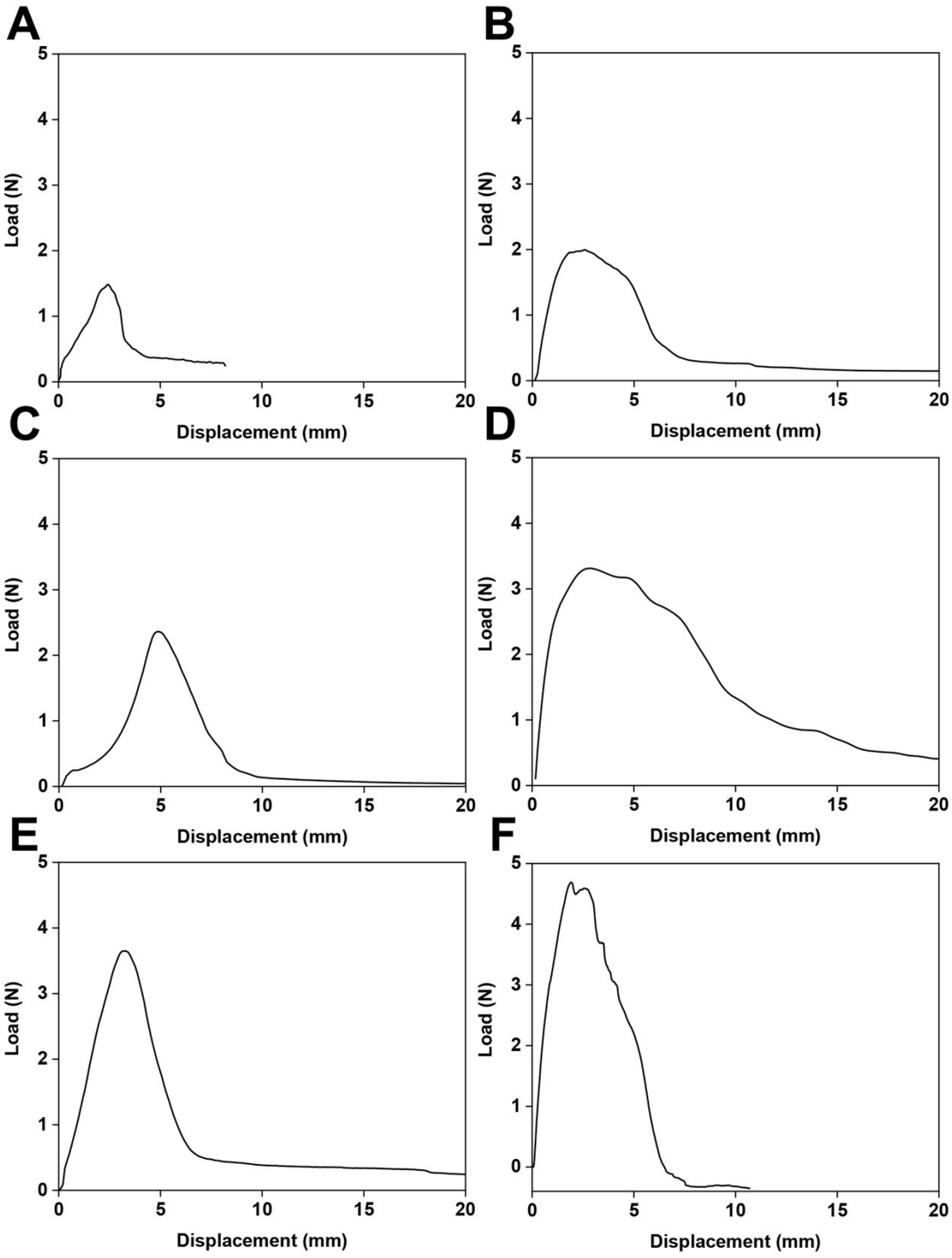

Figure S11. Load vs. displacement plot of (A) Alg-DA1 SC hydrogel; **(**B) Alg-DA1/Sr^{2+} DC hydrogel; (C) Alg-DA2 SC hydrogel; (D) Alg-DA2/Sr^{2+} DC hydrogel; (E) Alg-DA3 SC hydrogel and (F) Alg-DA3/Sr^{2+} DC hydrogel.

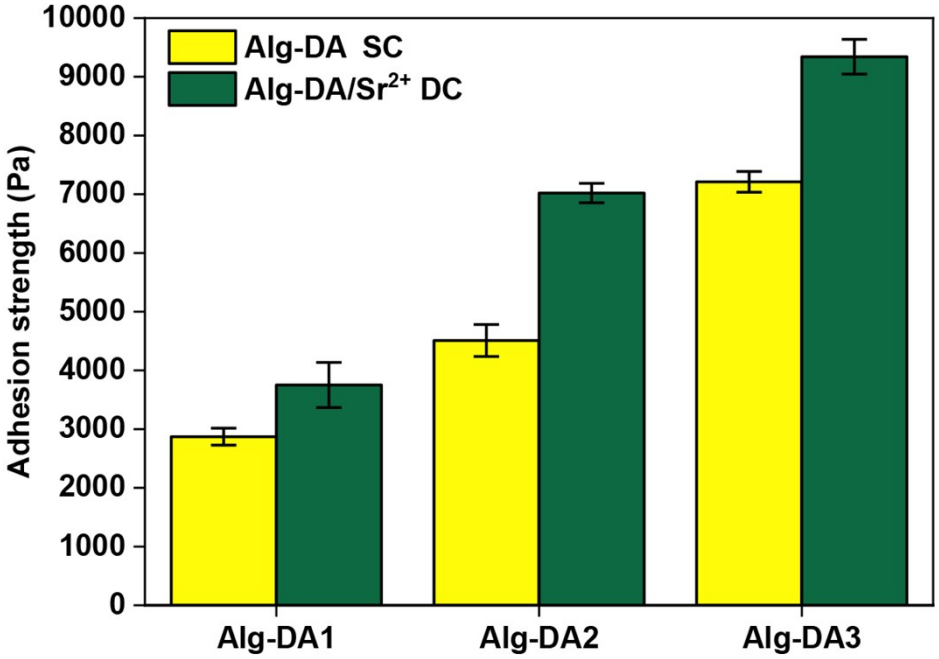

Figure S12. Adhesion strength of Alg-DA hydrogels on porcine tissues.

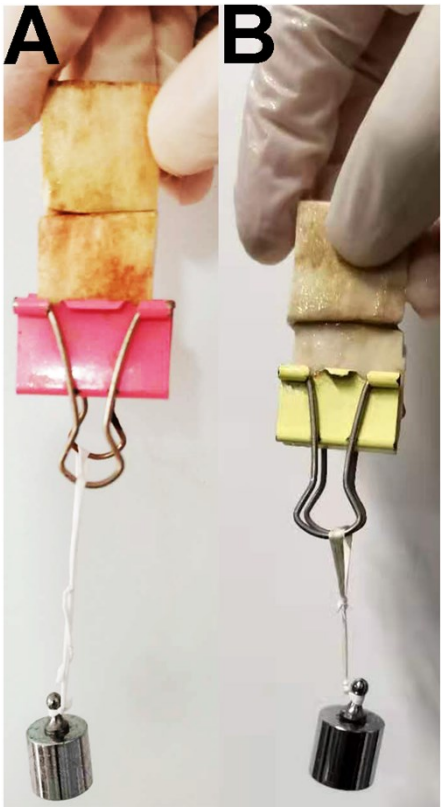

Figure S13. Photographic illustration of adhesion strength using two bovine bone tissues bonded with Alg-DA/Sr^{2+} DC hydrogel: (A) dry bovine bone tissues (contact area: 2 cm×0.5 cm; weight: 20g; load: 2 kPa); (B) wet bovine bone tissues (soaking the bone tissue in a buffer solution overnight. contact area: 2 cm×0.5 cm; weight: 20g; load: 2 kPa).

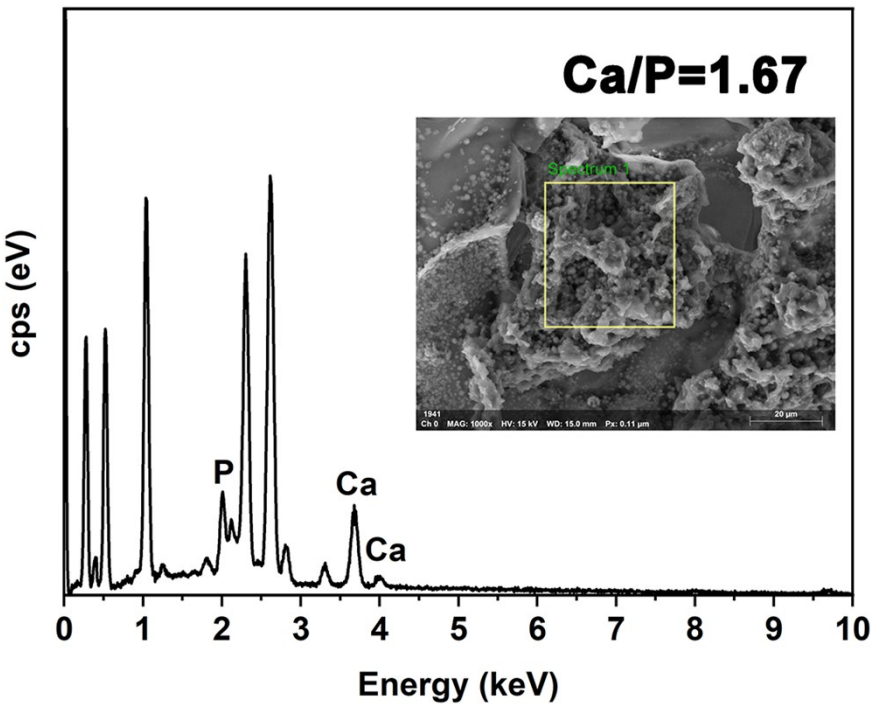

Figure S14. EDX spectrum of Alg-DA/Sr^{2+} DC hydrogel after being soaked in SBF for 28 days.

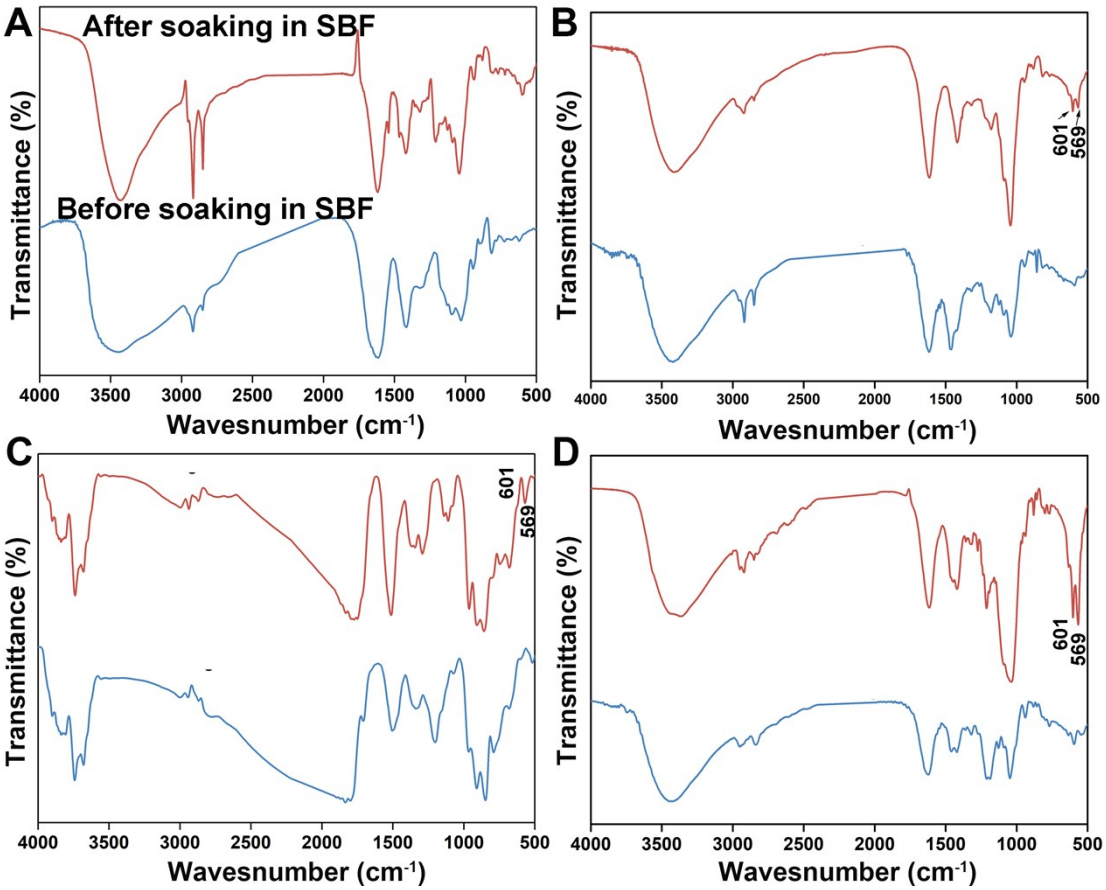

Figure S15. The FTIR spectra of hydrogels before and after being soaked in simulated body fluid (SBF) for 28 days. (A) Alg/Sr^{2+} SC hydrogel. (B) Alg-DA/Sr^{2+} SC hydrogel. (C) Alg-DA SC hydrogel. (D) Alg-DA/Sr^{2+} DC hydrogel. Red line: after soaking in SBF; Blue line: before soaking in SBF.

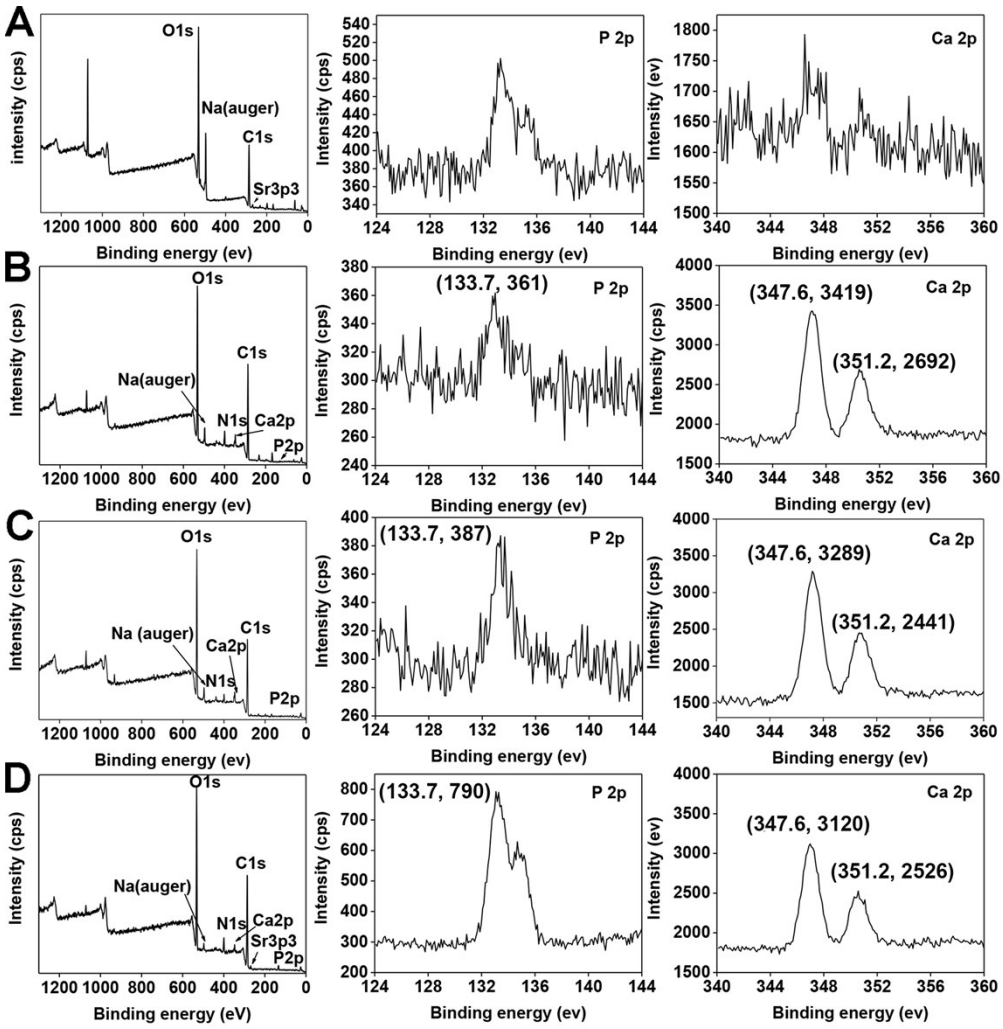

Figure S16. XPS spectra and XPS elements spectra of (A) Alg/Sr^{2+} SC hydrogel, (B) Alg-DA/Sr^{2+} SC hydrogel, (C) Alg-DA SC and (D) Alg-DA/Sr^{2+} DC hydrogel after being soaking in SBF for 28 days.

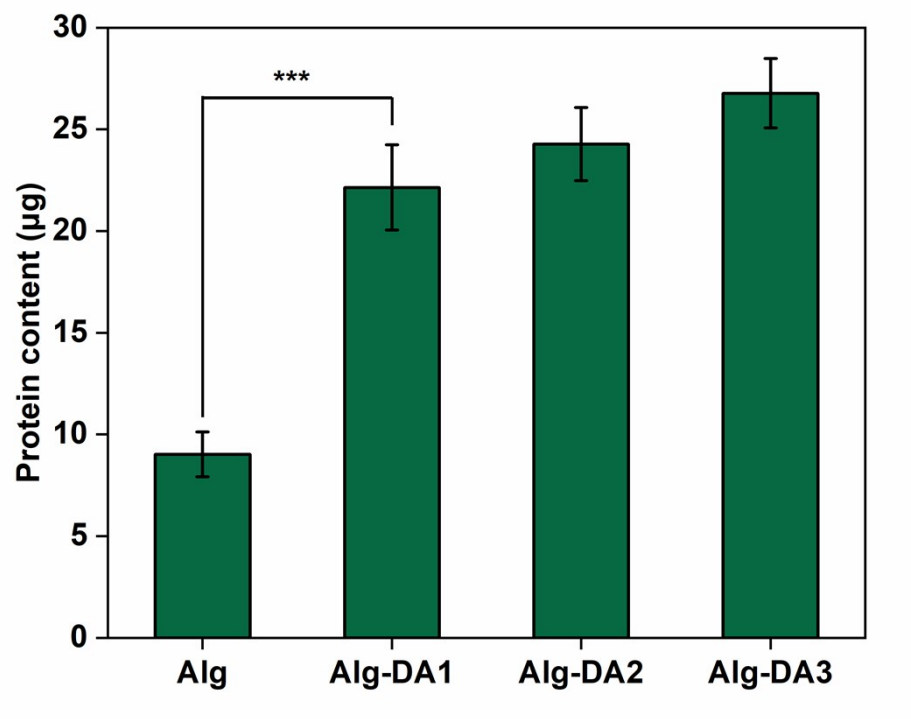

Figure S17. Protein adsorption of different hydrogels (Alg/Sr^{2+} SC, Alg-DA/Sr^{2+} SC). Mean values ± standard deviation. (***$p<0.001$) measured by one-way analysis of variance (ANOVA).

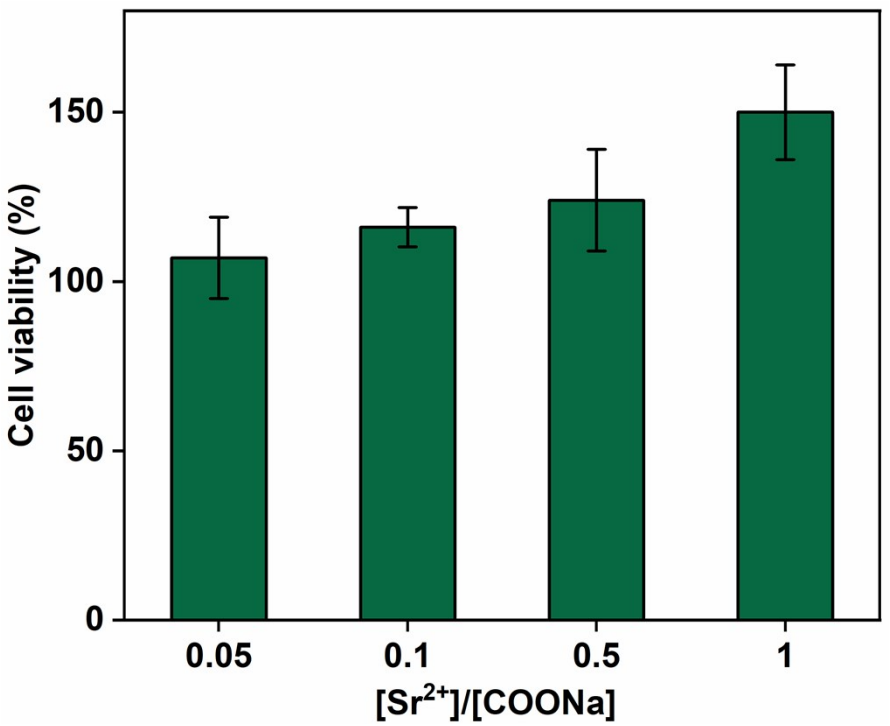

Figure S18. Cell viability of Alg-DA/Sr^{2+} SC hydrogels with different molar ratio of $[Sr^{2+}]$ to [COONa].

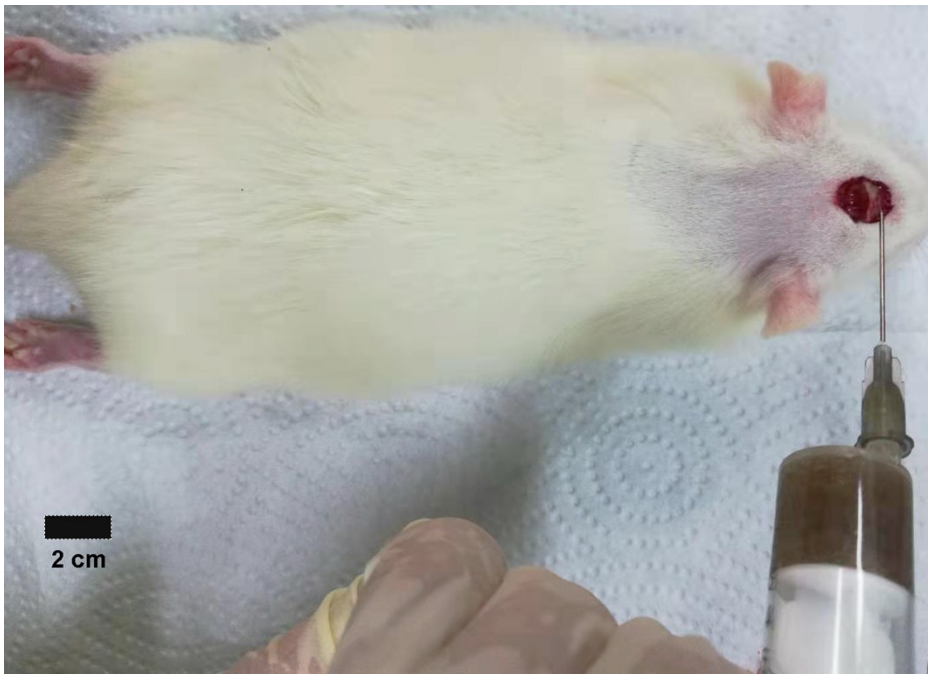

Figure S19. Hydrogel was injected to fill defect site.

Table S1. Synthesis of Alg-DA conjugates with various degrees of substitution (DS)[a].

Sample	Alg : DA[b]	DS(%)[c]
Alg-DA1	2 : 1	18.8
Alg-DA2	1 : 1	28.5
Alg-DA3	1 : 2	45.0

[a]Feeding molar ratio of Alg : EDC : NHS = 1 : 1 : 1. [b]The molar ratio of structural units in sodium alginate to dopamine. [c)]Calculation based on UV-vis spectra.