Electronic Supplementary Information (ESI)

Self-adhesive photothermal hydrogel film for solar-light assisted wound healing

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Synthesis polyethyleneimine (PEI)-modified reduced graphite oxide (GO) (PEI-rGO): GO was prepared by the modified Hummers method.[1] Briefly, 3 g of graphite powder and 1.5 g $NaNO_3$ were added to 70 mL of H_2SO_4 in a flask under ice bath, and then the mixture was stirred for 30 min. After that, 9 g of $KMnO_4$ was introduced slowly under vigorous stirring, and during this process, the temperature was lower than 20 °C. Then, the ice bath was removed and the reaction was kept at the temperature of about 35–40 °C for 30 min. Afterward, 140 mL of H_2O was slowly added into the mixture and the mixture was kept stirring for 30 min. Next, 500 mL of H_2O and 20 mL of H_2O_2 (30%) were introduced. Finally, the mixture was washed with HCl (1 M) for three times and dialysis against pure water to obtain GO aqueous dispersion.

In order to obtain PEI-rGO, similar procedures were carried out according to literature.[2] Briefly, well-dispersed GO aqueous suspension (2 mg/mL) was dropped into an equal volume of branched PEI aqueous solution (M_w=75K, 4 mg/mL) under ultrasonic condition. When being well mixed, the mixture was kept stirring at 60 °C for 24 h.

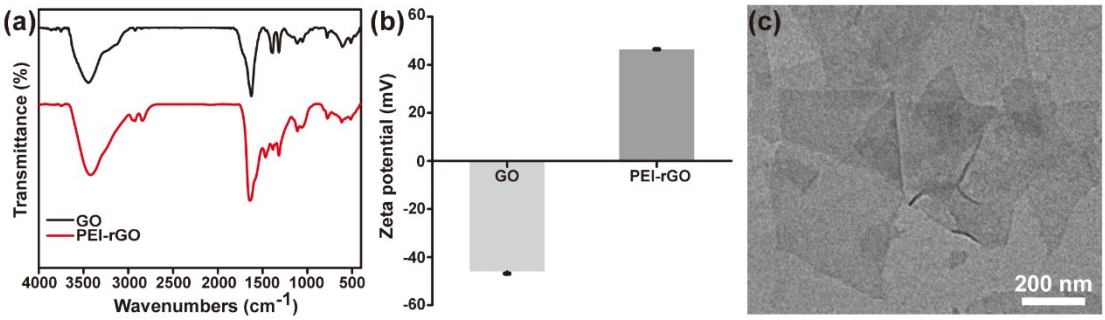

Figure S1. The modification of GO. (a) FTIR spectra of freeze-dried GO and PEI-rGO. (b) Zeta potential of GO and PEI-rGO dispersion. (c) TEM image of PEI-rGO.

For endowing the photothermal hydrogel film with great photothermal effect, rGO was chosen as the photothermal agent. Here, GO is prepared by the modified Hummers method, and branched PEI is utilized to modify GO to obtain PEI-rGO based on electrostatic interaction. The FTIR spectra of GO is similar to the previous study.[3] The characteristic peaks at 3447, 1625 and 1055 cm^{-1} are associated to the stretching vibration of hydroxyl, carboxyl and epoxy groups of GO. After modification with PEI, the characteristic peak of epoxy group is reduced to a certain degree, indicating GO has been partially reduced to rGO. The peak at 1467 cm^{-1} is referred to methylene of PEI, showing the successful modification of GO. Besides, the reversal of zeta potential of GO and PEI-rGO from negative to positive further proves this result (Fig. S1a and b). And the morphology of PEI-rGO indicates PEI-rGO is single lamellar nanosheet (Fig. S1c).

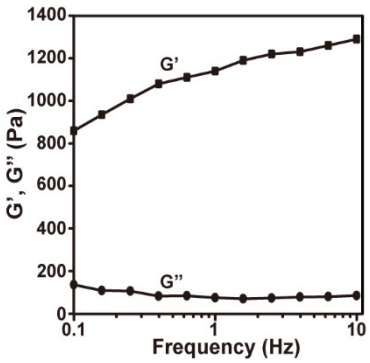

Figure S2. Rheological property of the hydrogel film as a function of frequency.

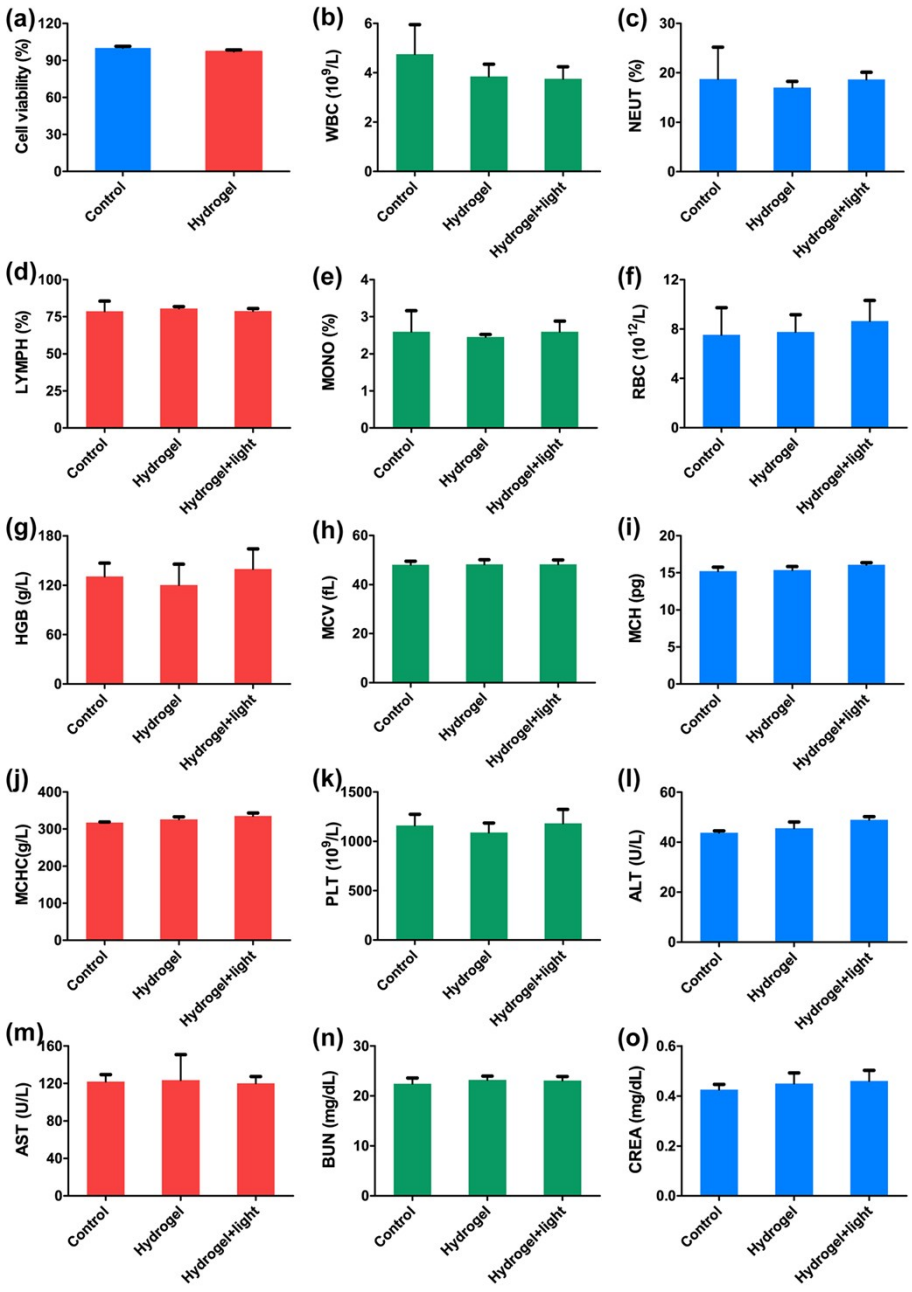

Figure S3. *In vitro* and *in vivo* experiments to evaluate the biosafety of the photothermal hydrogel film. (a) The viability of NIH3T3 cells measured by contacting leaching liquor of the hydrogel film for 24 h and control. (b–o) Hematology and blood biochemistry analysis of mice. WBC, white blood cells; NEUT, neutrophil; LYMPH, lymphocyte; MONO, monocyte; RBC, red blood cells; HGB, hemoglobin; MCV, mean cell volume; MCH, mean corpuscular hemoglobin; MCHC, mean corpuscular hemoglobin concentration; PLT, blood platelet; ALT, alanine transferase; AST, aspartate transferase; BUN, blood urea nitrogen; CREA, creatinine. Error bars represent the standard deviation.

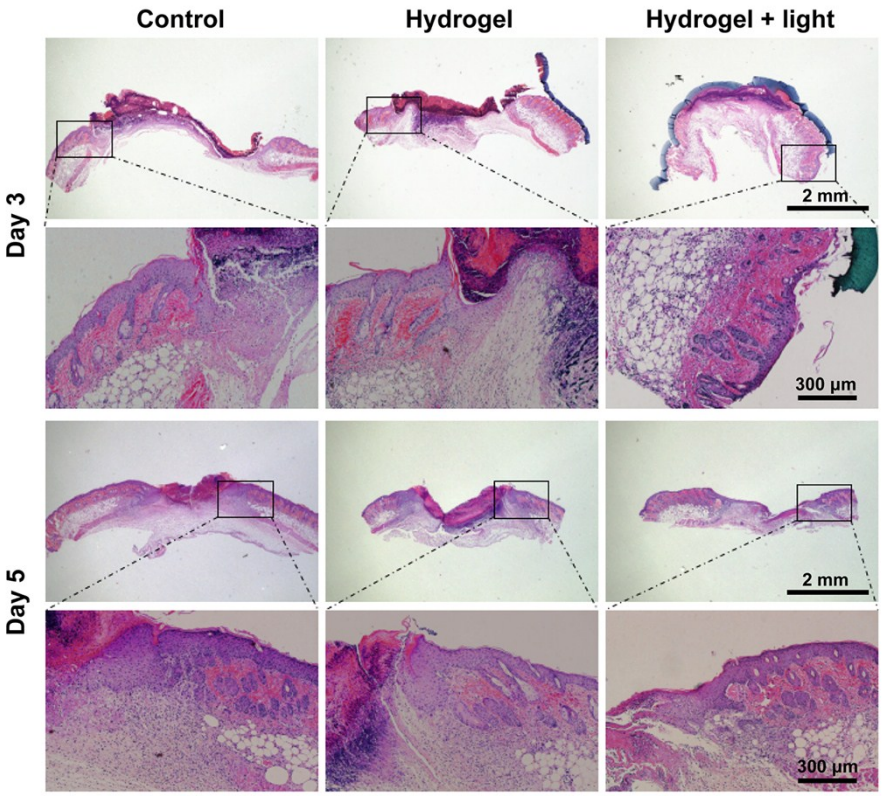

Figure S4. *In vivo* biocompatibility examination of the photothermal hydrogel film. Optical microscopic images of H&E stained tissue sections at the wound sites with adjacent normal skins in different groups at day 3 and 5.

Additional references

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