

## Electronic Supplementary Information

### **An accurate and dual-effective body slimming method through a soluble microneedle patch with variable temperature**

*Haichuan Peng<sup>a†</sup>, Yan Zhou<sup>a†</sup>, Chuxi Zhang<sup>a</sup>, Manyu Wang<sup>a</sup>, Siyu Zhao<sup>b</sup>, Yingying Xu<sup>b</sup>, Wei Zhang<sup>c</sup>, Hongbo Xin<sup>a</sup>, Xiaolei Wang<sup>a,c\*</sup>*

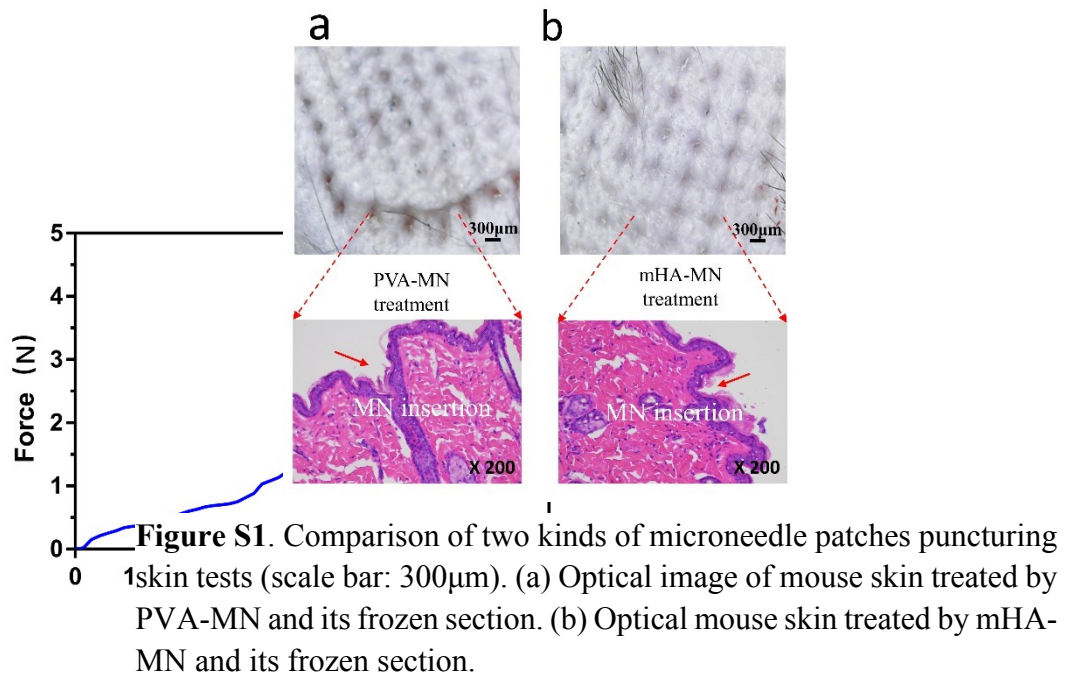
<sup>a</sup>The National Engineering Research Center for Bioengineering Drugs and the Technologies, Institute of Translational Medicine, Nanchang University, Nanchang, Jiangxi 330088, China.

<sup>b</sup>The Key Laboratory of Oral Biomedicine, The Affiliated Stomatological Hospital of Nanchang University, Nanchang, Jiangxi 330006, China.

<sup>c</sup>College of Chemistry, Nanchang University, Nanchang, Jiangxi 330088, China.

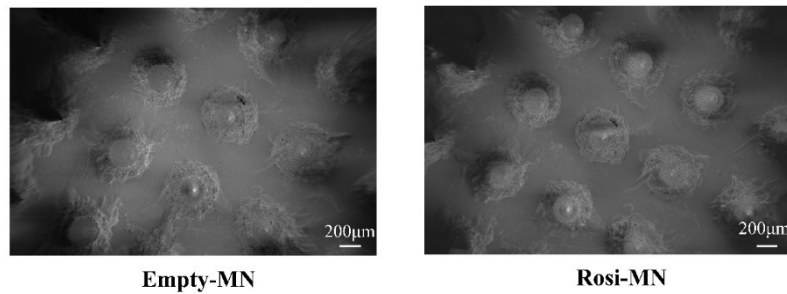
\* Email: wangxiaolei@ncu.edu.cn

† These authors contributed equally to this work.

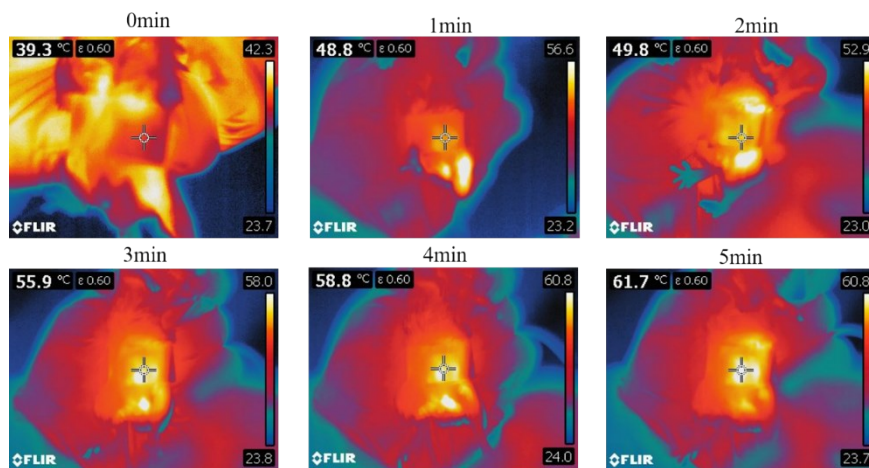


**Figure**

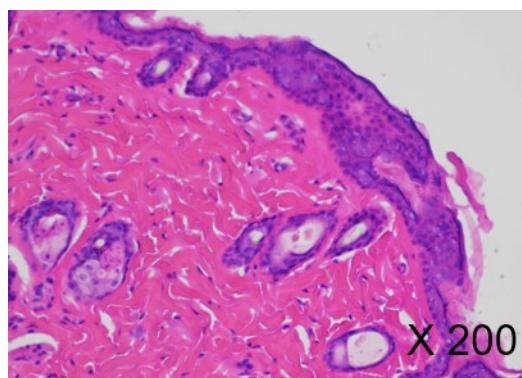
**S2.** Puncturing porcine skin test by using PVA-MN patch.



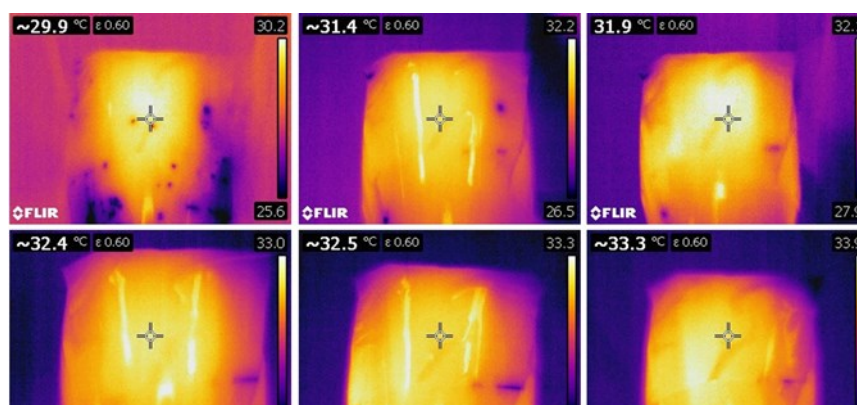
**Figure S3.** SEM images of other two kinds of MN patches (scale bar: 200µm).



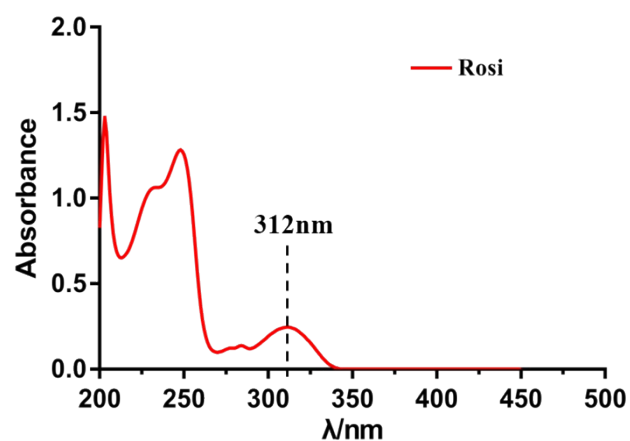
**Figure S4.** The MN patch was attached to the position of the mouse inguen, which was irradiated with near-infrared light, and the temperature change was recorded by infrared camera per minute (scale bar: 300 $\mu$ m).



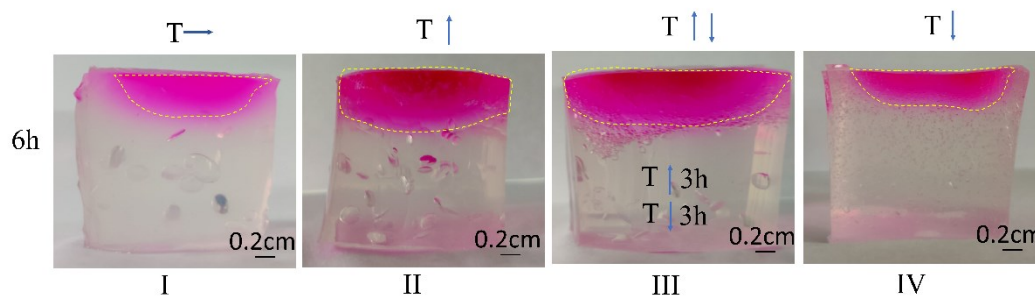
**Figure S5.** HE staining of treated mouse skin in inguen (X 200).



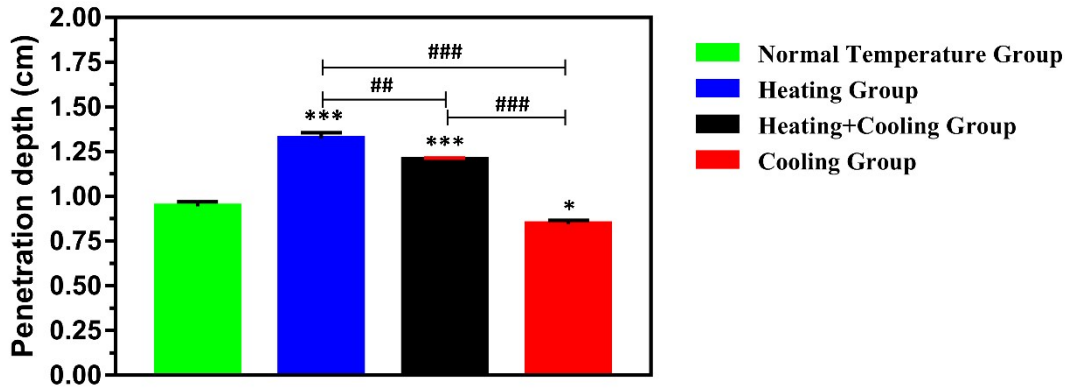
**Figure S6.** Body surface temperature changes under cooling stimulation (recorded every 10min).



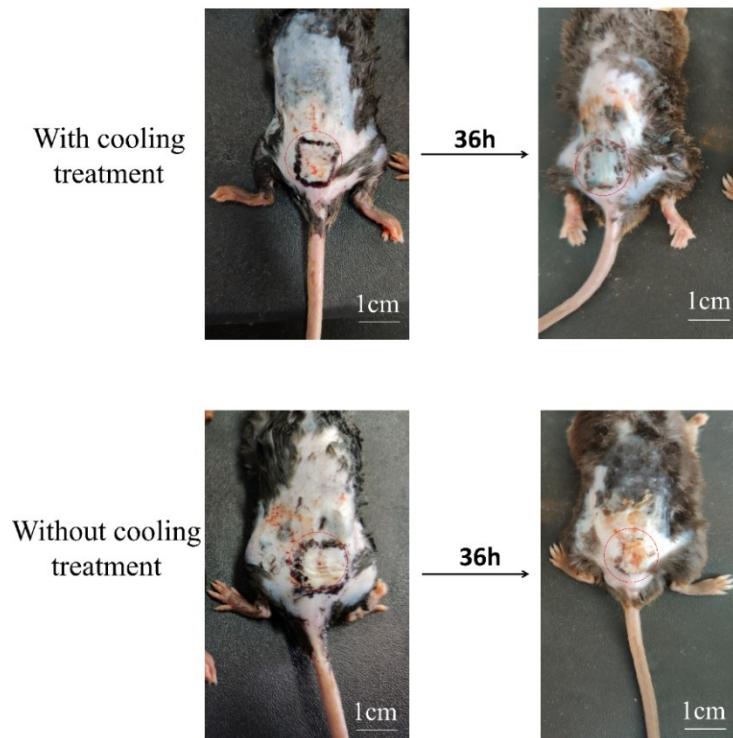
**Figure S7.** UV absorption of Rosi in 50% volume-fraction ethanol.



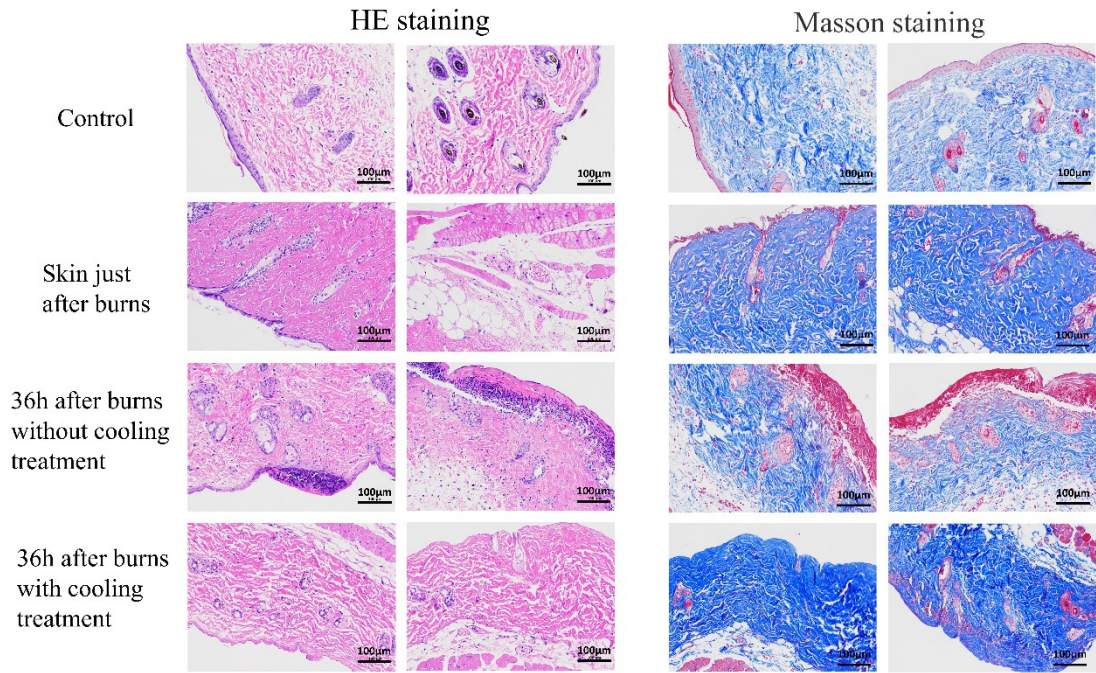
**Figure S8.** Four hydrogels were treated in four different kinds of ways. I: Normal Temperature Group, II: Heating Group, III: Heating + Cooling Group, IV: Cooling Group. The total time of penetration experiment was 6 h (scale bar: 0.2 cm).



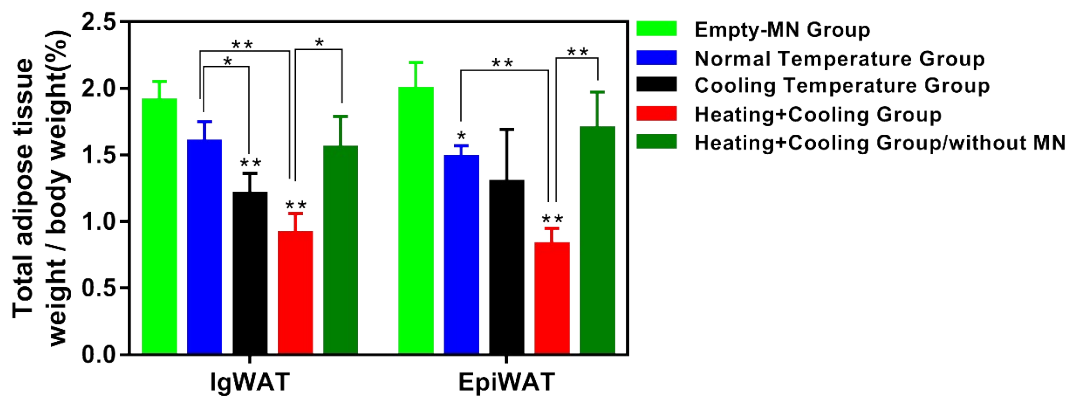
**Figure S9.** A histogram of penetration depth data. The penetration depth of each group was equally divided into 10 equal parts, and the depths were measured separately and arranged into figures. The statistics was mean  $\pm$  SEM (n = 10). Student's t-test: \*p < 0.05, \*\*p < 0.01, \*\*\*p < 0.001 between Normal Temperature Group and other three Groups; #p < 0.05, ## p < 0.01, ###p < 0.001 between indicated pairs.



**Figure S10.** The repair effect of ice packs on the burned skins. Normal mouse skin tissues were serviced as control (scale bar: 1cm).



**Figure S11.** HE staining and Masson staining of mouse skin tissues (scale bar: 100  $\mu\text{m}$ ).



**Figure S12.** The ratio of adipose tissue weight to total body weight of mice.