A magnetic responsive ovalbumin cryogel for rapid wound healing

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Wound healing is an important process that helps restore the function of damaged tissues, including the skin. In the era of global aging and rising incidence of chronic diseases such as diabetes, advanced wound healing strategies are becoming increasingly important. While there are many existing and developing wound dressings available, there is still an urgent need for more alternatives to choose from. In recent years, the emergence and development of new wound dressings show a trend from "passive protection" to "active repair", significantly improving wound healing performance. In this report, we adopt the concept of "active repair" and propose a new strategy of using a rotating magnetic field to stimulate an ovalbumin sponge embedded with magnetic nanoparticles at the wound site, which can significantly enhance wound healing.

A protein-based magnetic response composite sponge was developed. Combined with a self-designed miniaturized rotating magnet device, a "magnetic stimulation - material response" synergistic treatment system was constructed, effectively accelerating wound healing. The composite sponge mainly composed of ovalbumin, tannic acid and Fe_3O_4 nanoparticles was prepared by a secondary cross-linking process. It innovatively integrates three key wound-healing strategies into one platform: ideal microenvironment (porous sponge structure), antibacterial and antioxidant properties, and magnetic response mechanical stimulation. This multifunctional approach successfully overcomes the limitations of traditional wound dressings. In rat skin wound models, the composite sponge significantly accelerated the wound healing process by promoting angiogenesis and regulating related inflammatory factors. For liver penetrating injury models, it demonstrated excellent hemostatic and pro-coagulation capabilities, outperforming commercial gelatin sponges. Collectively, this "material-device" integrated composite platform shows great promise in promoting wound healing, and the composite sponge also exhibits remarkable advantages in treating internal non-compressible bleeding.