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GelMA/HAMA-CS/PCL Composite Hydrogel-Scaffold System Promote Wound Healing

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ABSTRACT

As the global prevalence of diabetes continues to rise, chronic diabetic wounds have become an important cause of amputation and death due to their protracted nature. In order to break through the limitations of traditional dressings, this study innovatively constructed a GelMA/HAMA-CS/PCL composite hydrogel-scaffold system containing chitosan based on biomaterials engineering and 3D printing technology. The system provides biomimetic ECM microenvironment through: photocrosslinked hydrogel layer (GelMA/HAMA-CS); Electrostatic spinning PCL film achieves mechanical strengthening and barrier protection. The chitosan component imparts long-term antibacterial activity, and the multi-materials cooperate to promote wound healing. In vitro antibacterial and cellular experiments showed that GelMA/HAMA-CS/PCL composite scaffold had excellent antibacterial activity and biocompatibility, which could significantly inhibit the activities of Staphylococcus aureus and Escherichia coli, and significantly promote the proliferation and migration of fibroblasts and epidermal cells. In addition, animal experiments have shown that composite scaffolds can have significant antibacterial effects in vivo, significantly inhibit inflammation, promote collagen secretion and vascular regeneration, and accelerate wound healing in rat models of Staphylococcus-infected wounds. The composite stent developed in this study effectively solved the problem of the imbalance of the microenvironment of diabetic wounds, and provided a new idea and technology for personalized wound repair.

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