Improved Wound Healing Using Patterned Gradients of Immobilized Biomolecules

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Technology description

More than five million people in the United States are afflicted with chronic skin wounds, resulting in billions of dollars in medical expenses each year. The incidence of chronic wounds is expected to increase, due to the growth in the elderly population and the number of people with diabetes.

Epidermal growth factor (EGF) is a key molecule in the wound healing process. It directs epithelial cells to migrate to the wound and proliferate, a process necessary for wound closure.

To speed healing of chronic or acute wounds, topical gels containing growth factors such as EGF have been used in wound dressings. However, these dressings have met with limited success. Many growth factors require prolonged exposure to cells, but topical agents are rapidly washed away from the wound or absorbed into the wound dressing. Growth factor concentrations frequently decrease by half within hours of contact with sterile gauze, and constant re-application is very expensive. UW-Madison researchers have developed a wound dressing with a patterned gradient of immobilized growth factors to accelerate wound healing. To create a platform that promotes directed migration of cells during dermal wound healing, growth factors are immobilized on a substrate in a pattern of increasing growth factor concentration, with the highest concentration typically at the center of the dressing. Cells migrate toward greater concentrations of growth factor, and their speed is determined by the slope of the gradient. The surface may also include an extracellular matrix protein, such as collagen, fibronectin or laminin, and/or a factor that promotes the formation of blood vessels.
The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a wound dressing that uses a patterned gradient of immobilized growth factors to accelerate wound healing.

Application area

Potential Applications

Wound healing
Cell migration assays

Advantages

Promotes improved wound healing
Provides a ten-fold increase in cell migration speed as compared to control surfaces
Accelerates wound closure, which reduces patient suffering and the cost of wound treatment, and may also minimize scarring and lead to the formation of a more stable closed wound
Photo-patterning techniques enable precise control over the spatial location of growth factors, and allow both the speed and direction of migration to be controlled.
Immobilized EGF remained biologically active for several weeks, as compared to less than two hours for free EGF, as demonstrated by test results.
Allows lower concentrations of immobilized biomolecules to be used, reducing the cost of wound treatment
Patterning techniques simplify fabrication of wound dressings and may be easily scaled up.
Two-dimensional patterning methods can be translated to three-dimensional dressings.
Multiple growth factors or proteins can be immobilized to create different gradient patterns.
May enable multiplex analysis of how different growth factor combinations affect cell migration
Can be used to screen for agents that promote cell migration by immobilizing a test agent to the surface and evaluating the ability of cells to migrate across the gradient

Institution

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