Extracellular Matrix Scaffold with Antimicrobial Activity

WPI

Antimicrobial, cell-derived extracellular matrix scaffold for improved wound healing and tissue repair

TITLE
Matrix Scaffold with Antimicrobial Activity

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PATENT
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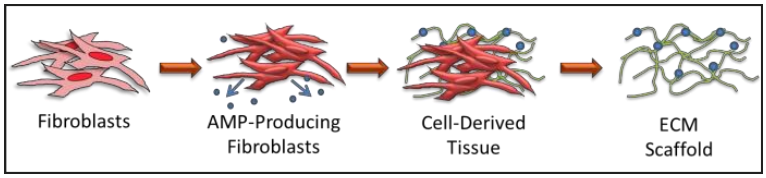
BACKGROUND

Skin is the body's main protective barrier against injury. Significant wounds caused by burns, physical trauma, surgeries, and other underlying pathologies can lead to impaired tissue regeneration and loss of barrier function. Scaffolds have been used as a therapeutic mechanism for tissue repair and regeneration. Current scaffolds, however, have the limitations of inadequate biocompatibility and biodegradability, mechanical and structural mismatch with the native tissue, and susceptibility to infection.



The current invention addresses the lack of antimicrobial activity and infection control in natural and synthetic tissue replacements by creating a novel cell-derived extracellular matrix (ECM) scaffold with antimicrobial properties. The tailored scaffold has tremendous potential for improving wound healing and infection control, stimulating tissue repair and regeneration, and restoring structure and/or function of a variety of injured tissues.

SUMMARY

- To produce a scaffold entirely from ECM, human dermal fibroblasts are cultured into tissue sheets in media supplemented with ascorbic acid to increase collagen expression.
- To prevent or treat wound infection, fibroblasts are genetically modified to produce a chimeric antimicrobial protein (AMP), which contains domains from human cathelicidin (LL-37), an AMP that is naturally synthesized in the epidermis, and a collagen-binding domain to tether the AMP to the ECM.
- The fibroblast-derived ECM scaffold containing chimeric AMP is decellurized to produce a cell-free product.
- The collagen binding domain allows retention of the AMP within the scaffold after the cells have been removed.

ADVANTAGES

- The scaffold provides the structural and mechanical properties of native dermis and actively prevents wound infection.
- The cells can be genetically modified to express additional factors, including growth factors, ECM molecules and ECM-associated molecules that promote enhanced angiogenesis, quicker wound closure, functional tissue regeneration, tunable mechanical properties and infection treatment and prevention.
- A fusion protein with these unique binding collagen domains and antimicrobial activities is currently not available in the market.
- Can be applied to any tissue, for example, dermal, periodontal, cardiovascular, orthopedic, craniofacial, musculoskeletal, endocrine, or gastrointestinal.
- Improved wound healing and tissue regeneration with reduced infection results in lower medical costs and less patient discomfort.

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