Methods to promote eye wound healing

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Technology description

The management of corneal and ocular surface wounds has not changed significantly in the last few decades and consists mainly of measures such as lubrication, patching, and antibiotics that support but do not promote wound healing. In severe injuries and disease such as chemical burns and Stevens-Johnson Syndrome, irreversible visual loss often occurs in spite of such measures. Thus, there remains a major clinical need for technologies that specifically promote regeneration of the cornea and ocular surface. The administration of the therapeutic factors secreted by harvested stem cells is an attractive and viable option for treating wounded or diseased tissue that avoids the uncertainties and challenges of delivering actual stem cells into patients. Yet, simple topical delivery of soluble therapeutic factors to the eye is limited and cost-inefficient due to fluid turnover from tearing and drainage through the lacrimal pathway. Of particular benefit would be a vehicle that could deliver these therapeutic factors in a sustained fashion while maintaining their bioactivity and also serving as a protective membrane to the wound itself. Our hypothesis is that an in situ forming, viscoelastic gel carrier can facilitate the optimum delivery of the secreted factors of bone-marrow derived human mesenchymal stem cells (hMSCs) to the eye. In this work, the secreted factors of hMSCs will be produced, collected, and packaged in lyophilized form ex vivo, and then encapsulated within a protective, tissue-adherent hyaluronic acid-based gel on the corneal wound surface. The technology leverages the inherent biocompatibility and favorable biophysical properties of hyaluronic acid as well as the controllable production of secreted factors from cultured stem cells. The ultimate goal of this research is to lay the groundwork for a novel regenerative therapy for severe ocular surface injuries and disease.
Researchers at Stanford have developed methods to improve eye wound healing. The cornea (the outermost tissue of the eye) is highly vulnerable to the blinding consequences of severe injury or disease as it has limited ability to heal. Currently, treatment of eye wounds is suboptimal as it consists mainly of supportive measures such as lubrication, antibiotics, steroids and patching. Furthermore, topical delivery of therapeutics is inefficient as the therapeutics are quickly washed away by tearing. Thus, there is a need to develop more effective strategies to promote eye wound healing. To help meet this need the inventors have developed this wound healing modality. It combines (1) Mesenchymal stem cell (MSC) secreted factors (cytokines and growth factors) which play an important role in tissue repair and maintenance and (2) a light-cured, hyaluronic acid (HA) -based gel to encapsulate and secure the secreted factors within a protective membrane on a wound surface. The secreted factors are mixed with the gel and applied to the eye surface at the point-of-care to form a protective coating and

promote wound healing. This technology provides a much-needed method to improve eye wound healing.

Application area

Wound healing
For severe surface injuries and diseases of the eye, including:
Chemical injury Traumatic injury Stevens-Johnson Syndrome Neurotrophic keratopathy
Potential for use with non-healing skin wounds

Advantages

Addresses a major clinical need- provides a treatment for eye injuries that are not effectively treated by current methods Method:
Uses a biocompatible HA-conjugate that forms an adherent membrane on a wound in situ Delivers therapeutic factors in a sustained manner Maintains bioactivity of therapeutic factors Provides a protective membrane for the wound itself
Method leverages:
Inherent biocompatibility and favorable biophysical properties of HA The safety profile of riboflavin-based crosslinking via visible light Highly controllable production of secreted factors from hMSCs
HA is already FDA- approved as an ophthalmic viscosurgical device May be able to expand the method for use with burns and non-healing skin wounds

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