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Effets d'une exposition électrique sur les paramètres de la guérison des plaies cutanées : Analyse à l'aide de modèles humains in vitro. (Effects of exposure to electricity on skin healing parameters: analysis with in vitro human models) Thesis.
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Abstract

Most living organisms are subject to endogenous electrical phenomena. Mammals have a physiological battery that resides in their living skin. When they are injured, the battery short circuits and produces an electric current that exits through the wound. This current generates an electric field (EF) that may be involved in the skin's healing process. Exposure to electricity is a clinical treatment that is gaining acceptance for healing various tissues. However, the roles and active healing mechanisms of EFs are still not well understood. We have used various *in vitro* human models and two innovative exposure systems to study the effects of an exogenous EF on the various parameters involved in healing skin.

A physiological electric field causes morphological changes in skin cells cultivated in a monolayer. The fibroblasts become aligned perpendicularly to the EF in response to reorientation of actin and tubulin filaments. The response of the epithelial cells is less obvious. The keratinocytes around the periphery of the colonies assume the same direction as the fibroblasts, and so does the shape of the colonies. Cell and collagen-fibre orientation is not affected in reconstructed dermis exposed to an EF. Exposure of the healing model to electricity causes detachment at the dermis/epidermis interface of intact reconstructed skin. This result supports the hypothesis that the endogenous EF modifies the adhesion of epithelial cells around the wound to initiate migration and the reepithelialization process. Moreover, a decrease in laminin 5 and integrin α6ß4 was observed at the edge of the wound. In this way, the EF may influence hemidesmosome restructuring in the wound to keep the cells migratory. The addition of an exogenous EF to the new healing model was used to develop a very powerful research tool to study skin healing parameters. This will enable us to examine the different electrical parameters (time, amplitude, treatment frequency, etc.) that will produce results that can be applied in electrotherapy to heal skin.