Enhancement of topical 5-aminolaevulinic acid delivery by erbium:YAG laser and microdermabrasion: a comparison with iontophoresis and electroporation沈杏娟

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Abstract

BACKGROUND: 5-aminolaevulinic acid (ALA) is used as a protoporphyrin IX-precursor for the photodynamic therapy of superficial skin cancer and cutaneous metastases of internal malignancies. However, the permeability of hydrophilic ALA across the skin is very low. OBJECTIVES AND METHODS: The objective of this study was to optimize and enhance the in vitro skin permeation of ALA by two resurfacing techniques: erbium:yttrium-aluminium-garnet (Erb:YAG) laser and microdermabrasion. Light microscopic changes in pig skin caused by these techniques were also compared. The electrically assisted methods, iontophoresis and electroporation, were also used to facilitate ALA permeation across laser- or microdermabrasion-treated skin. RESULTS: Among the modalities tested in this study the Erb:YAG laser showed the greatest enhancement of ALA permeation. The laser fluence was found to play an important role in controlling the drug flux, producing enhancement ratios from 4-fold to 246-fold relative to the control. The skin permeation of ALA across microdermabrasion-treated skin was approximately 5-15-fold higher than that across intact skin. Both the ablated effect of the stratum corneum (SC) and ALA flux were proportional to the treatment duration of microdermabrasion. The application of iontophoresis or electroporation alone also increased the ALA permeation by approximately 15-fold and 2-fold, respectively. The incorporation of iontophoresis or electroporation with the resurfacing techniques caused a profound synergistic effect on ALA permeation. CONCLUSIONS: This basic study has encouraged the further investigation of ALA permeation by laser or microdermabrasion.