Erbium:YAG laser enhances transdermal peptide delivery and skin vaccination.

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摘要

Abstract

Transdermal delivery of peptides and the related vaccines is attractive for treatment and prevention of diseases. However, this delivery method is limited by the low permeability of the stratum corneum (SC). The objective of this study was to enhance and control skin permeation of peptides and related vaccines using an erbium:yttrium–aluminum–garnet (Er:YAG) laser. The amount of peptide transported through nude mouse skin was measured using a Franz diffusion apparatus. The SC layer was partly ablated by an Er:YAG laser, resulting in a greater enhancement effect on peptide delivery. A thinned and discontinuous SC layer was observed after laser exposure. The flux of peptides across skin treated with a laser at various fluences was 3– 140-fold higher than that across intact skin. The molecular size, lipophilicity, and sequence of the peptides were found to play important roles in modulating the enhancement of activity. The result of confocal laser scanning microscopy (CLSM) indicated a significant increase in the skin deposition of peptides into lasertreated skin. In an in vivo study, mouse skin was treated with the laser followed by skin vaccination with a lysozyme antigen. It was demonstrated for the first time that laser treatment with no adjuvant or penetration enhancer significantly enhanced the production of antibodies in the serum by 3-fold. To reveal the mechanisms underlying these changes, a proteomic technique combined with mass spectrometry was used. This is, to our knowledge, the first report of a laser being used to immunize intact animals.