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Drug delivery into microneedle-porated nails from nanoparticle reservoirs

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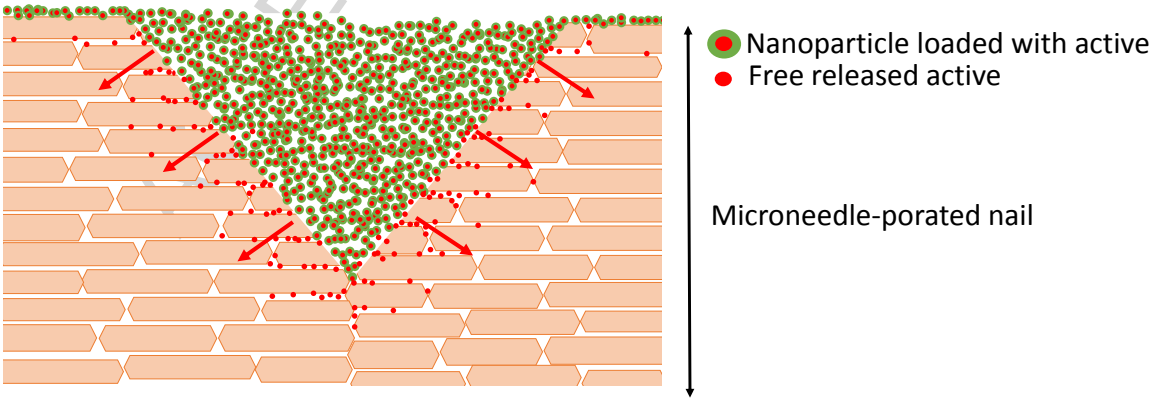
Abstract

This study demonstrates the potential of polymeric nanoparticles as drug reservoirs for sustained topical drug delivery into microneedle-treated human nail. Laser scanning confocal microscopy was used to image the delivery of a fluorescent model compound from nanoparticles into the nail. A label-free imaging technique, stimulated Raman scattering microscopy, was applied, in conjunction with two-photon fluorescence imaging, to probe the disposition of nanoparticles and an associated lipophilic 'active' in a microneedle-porated nail. The results provide clear evidence that the nanoparticles function as immobile reservoirs, sequestered on the nail surface and in the microneedle-generated pores, from which the active payload can be released and diffuse laterally into the nail over an extended period of time.

Graphical abstract



Laser scanning confocal microscopy together with stimulated Raman scattering microscopy and two-photon fluorescence imaging provide clear evidence that nanoparticles function as immobile reservoirs from which an 'active' can be released into microneedle-porated nails.

Keywords: nail, nanoparticles, microneedle poration, drug delivery, stimulated Raman scattering