

Nano Photodynamic Therapy in Wound Healing

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ABSTRACT

Photodynamic therapy (PDT) is an emerging, non-invasive therapeutic strategy that involves photosensitizer (PS) drugs and external light for the treatment of diseases. The principal medical application during the last century was in cancer therapy but, in these days of rising antibiotic resistance, PDT shows increasing promise as an alternative approach to treating infections (Photodynamic inactivation (PDI)). Despite the great progress in PS-mediated PDT, their clinical applications are still hampered by poor water solubility and tissue/cell specificity of PS drugs. In the last decade, PDT has also been combined with nanotechnology techniques, as the photochemical effectiveness can be greatly enhanced by the use of nanoparticles. Different approaches have been investigated to combine nanoparticles and PDI, for antimicrobial applications. One use of nanoparticles is to improve the binding and uptake of PS by the microbial cells; while another use is to improve the microbial photoinactivation kinetics. Many different kinds of nanoparticles such as titanium nanoparticles, carbon nanomaterials (fullerenes, carbon nanotubes and graphene), liposomes and polymeric nanoparticles have been studied to potentiate antimicrobial PDI. Natural polymers (chitosan and cellulose), gold and silver plasmonic nanoparticles, mesoporous silica, magnetic and upconverting nanoparticles have all been used for PDI. Altogether, the future looks bright for the long and happy marriage of antimicrobial photodynamic inactivation and nanomedicine.

Keywords: Photodynamic Therapy, Wound Healing, Nanoparticles