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Synthesis of bifunctional therapeutic silver-pyridoxine nanoparticle with antibacterial and proliferative activity

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Introduction: Silver nanoparticles have attracted great attention due to their enhanced antibacterial properties arising from larger surface area per volume compared to silver ion. The moisturizing effect inherent to silver nanoparticles also contributes greatly to its use as a topical antibacterial agent for wound healing. The antibacterial property of silver nanoparticles provides topical wounds with an indirect environment for healing by the prevention of pathogenic infection. However, the direct wound-healing effects of silver nanoparticles have not been explored until now. The wound healing involves a number of complex processes such as epithelialization. Although antibacterial effect on wounded skin provides a suitable environment for epithelialization to occur, it does not accelerate epithelialization directly. In order for silver nanoparticles to be a more powerful topical therapeutic agent, it is necessary to have a direct wound healing activity in addition to antibacterial effect. In this work, we report a bimodal therapeutic silver nanoparticle that possesses both direct wound-healing and antibacterial properties.

Results: The synthetic nanoparticles consisted of high-valent silver-pyridoxine complexes to achieve bi-functional therapeutic activities of both antibacterial and proliferative property. An MAPK pathway study proved that silver nanoparticle induced proliferation and migration to keratinocyte and fibroblast cells. Antibacterial activities in 10 different pathogenic bacteria responsible for the infection of burn wound were tested. Its wound-healing efficacy was verified through diabetic mice as well as *in vitro* assay. Faster wound healing occurring on the skin wound of diabetic mice attested great potential of bimodal therapeutic silver nanoparticles as a next-generation topical therapeutic agent.

Conclusions: From the scrape assay and signaling pathway study, it is clear that silver-pyridoxine nanoparticle accelerates the proliferation and migration of fibroblast and keratinocyte cells. Silver-pyridoxine nanoparticle promotes the process of wound healing in diabetic mice. These wound healing efficacies, along with the antibacterial and moisturizing properties inherent to SPN, are expected to pave the way for next-generation topical silver nanotherapeutic agents.

Biography:

Prof. Joon Myong Song received his Ph.D. in 1997 at Kyushu University, in Japan. He worked as a postdoctoral research fellow from 1998 to 2004 at Iowa State University, Brookhaven National Laboratory, and Oak Ridge National Laboratory in United States. At present he is a professor and head of Department of Pharmacy at College of Pharmacy, Seoul National University in South Korea. His research area includes multifunctional nanoparticle for diagnosis and therapy and high-content cell-based drug screening and diagnosis using hyper-multicolor cellular imaging. He has published 87 peer reviewed papers in the top journals, 7 book chapters, and 10 patents.