High-tech silver dressings ward off infection in wounds

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(Phys.org) -- Applied onto the business end of artificial skin, nanofilms that release antibacterial silver over time can eradicate bacteria in full-thickness skin wounds in mice.

Pioneered by a multidisciplinary team of researchers from the University of Wisconsin-Madison, University of Colorado-Denver, and University of California, Davis, such antibacterial wound dressings someday could benefit millions of people worldwide who suffer from serious burns or chronic wounds.

The team described its results in a paper published in the August 2012 issue of the journal Annals of Surgery.

In the United States, some seven million people suffer from chronic wounds or serious burns. Their journey to recovery often is plodding, and pockmarked with setbacks, prolonged excruciating pain, and an ever-present risk of infection. Many of these people endure multiple daily dressing changes during which nurses clean their wounds and cover them with gauze soaked in antimicrobial agents to ward off infection.

Approximately 20 percent of patients develop infection in their wounds. And infected, difficult-to-heal wounds such as diabetic foot ulcers can lead to amputation, says Dr. Michael Schurr, a corresponding author on the paper. "The real question is bacteria in wounds," says Schurr, formerly a clinician and professor of surgery at UW-Madison and now a professor of surgery in the University of Colorado School of Medicine.

"If you take an antibiotic pill, the antibiotics circulate through your body but don't really contact the surface of your skin. That's why we're heading to antibacterial dressings."

Applied to wounds or burns, artificial skin promotes wound healing and reduces the discomfort associated with wound care. Also known as a biologic dressing, artificial skin consists of two layers: The bottom layer contacts the wound and contains biological compounds that encourage new skin cells to grow, while the top layer acts like a protective covering until the wound heals.

While antimicrobial agents help kill infection-causing bacteria, high concentrations of antimicrobial agents are toxic to the biological components in artificial skin, slowing the healing process.

Silver is effective as an antimicrobial agent-even against drug-resistant bacteria. However, until now, it has not been possible to incorporate silver into artificial skin because traditional methods, such as dip-coating, are too harsh on the delicate biological components in artificial skin, says Ankit Agarwal, a UW-Madison honorary research associate in chemical and biological engineering and co-lead author of the paper. "The industry has been looking for new methods," he says.

Working with Nicholas Abbott, the John T. and Magdalen L. Sobota professor of chemical and biological engineering at UW-Madison, Agarwal developed polymer nanofilms that contain precise amounts of silver nanoparticles that release over 10 days. With inspiration from techniques used in the electronics industry, the researchers also devised an ingenious method for "stamping" the nanofilms onto the soft bottom layer of commercially available artificial skin. "A lot of wound dressings are very specialized," says Schurr. "One of the advantages of the nanofilms is that they don't change the properties of the dressings."

The nanofilms do, however, eradicate bacteria. Agarwal and Kathleen Guthrie, a postgraduate trainee in the School of Veterinary Medicine at UW-Madison, tested the artificial skin in mice with full-thickness skin wounds, or those in which all layers of skin are removed. They added bacteria to the wounds and applied artificial skin with and without the silver nanofilms. After just three days, wounds dressed artificial skin resulted in persistent infections, while wounds with the silver-modified artificial skin contained significantly less bacteria.

It's research that supports results of the team's prior laboratory-based studies. Now, in partnership with companies that manufacture artificial skin, the team will work toward clinical trials, as well as identifying specific areas-for example, dressings for burn victims who are children-where antimicrobial wound dressings can make the biggest impact. "The whole point here is to improve the care of people with medical problems and this partnering process is very important," says Schurr.

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