The American Ceramic Society
NEWS RELEASE

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**Revolution in wound care? Inexpensive, easy-to-use cotton candy-like glass fibers appear to speed healing in initial venous stasis wound trial**

**Expanded borate glass fiber human testing to begin soon in Chicago**

WESTERVILLE, OH – Imagine a battlefield medic or emergency medical technician providing first aid with a special wad of cottony glass fibers that simultaneously slows bleeding, fights bacteria (and other sources of infection), stimulates the body's natural healing mechanisms, resists scarring, and—because it is quickly absorbed by surrounding tissue — may never have to be removed in follow-up care.

Or, imagine diabetics with hard-to-heal wounds finding a source of relief from the battle against infections and limb amputation.

Those scenarios are the hope of the developers of a revolutionary borate glass nanofiber material, which appears have sped and helped the final of healing long-term wounds in eight out of 12 venous stasis wound sufferers in a recent clinical trial held at a medical center in Rolla, Mo.

Details about the trials and the glass fiber material were published today in the May issue of the American Ceramic Society's *Bulletin* magazine.

The story reports on the discovery of the fibers and on an empirical study that began late in the fall of 2010 supervised by the internal review board of the Phelps County Regional Medical Center. The trial groups originally had 13 volunteer members, but one dropped out during the early stages.

According to Peggy Taylor, the PCRMC registered nurse who administered the treatments, all of the volunteers who took part in the trial are enthusiastic about the use of the glass fiber product, which she says "looks like cotton candy."

"All of the participants had diabetes and several of them had wounds that had been unhealed for more than a year," says Taylor, a specialist in wound care. "One patient had the same wound for three years. After using the glass fiber product for a few months, we were able to repair the skin in eight of the patients. Remarkably, the other four have made a lot of progress and all of their wounds should be healed soon, too."

The patients in the test group suffered from problems associated with venous stasis, a condition where blood circulation in extremities is poor. As the blood pools, typically in lower legs, fluids accumulate causing unusually high pressure on skin tissues. Sores and wounds can then develop when the fluid "weeps" from skin cracks, cuts or abrasions. Because of an enzyme in the weeping fluid, the skin surrounding small venous stasis injuries can quickly erode and turn into large and deep wounds. Even small bruises can eventually develop into bone-deep openings.

The goal of the PCRMC trial was to provide an initial evaluation of the effects of the novel fibrous glass material produced by the Mo-Sci Corporation, a Rolla company already known for creating glass-based materials for medical applications.

"Bioglass" materials aren't particularly new to the medical field, but thus far all bioglass has been formed from silica-based glass compositions, and these primarily have been used in hard-tissue regeneration, such as bone repair.

Glass scientist Steve Jung, who helped develop the new material, says he and co-developer Delbert Day had wondered whether a different type of bioactive glass material could be used for soft-tissue regeneration. "Our in-vitro studies showed that bioactive glasses containing boron should react to body fluids much faster than silicate glasses," says Jung, who obtained his Ph.D from Missouri University of Science and Technology, where he conducted his research with Day, a professor at the university. "We also knew that another in-vitro study of lithium borate glasses had showed it to have beneficial effects against bacteria, such as E. coli, salmonella and staphylococcus microbes."

Lastly, Jung and Day recall they were interested in a composition that was rich in calcium. "Previously, investigators have reported that calcium is important for wound healing. It appears to assist the migration of epidermal cells and help the body regulate the healing process of open wounds," says Jung.

Besides composition, Jung and Day thought the structure of the material may be important to consider, too, and suspected that providing a healing "scaffold" might be beneficial to skin reconstruction. "We wanted to have a material that could mimic the microstructure of fibrin that normally forms the basis of a blood clot. We reasoned that if the structure could imitate fibrin, it might trap blood platelets and allow the formation of a wound cover that could support the healing process."

Jung and Day finally settled on a particular borate glass composition — called 13-93B3 glass —that Mo-Sci, a company founded by Day, already knew how to form into cottony glass fibers, 300 nanometers to 5 micrometers in diameter.

After animal tests showed no adverse effects, Mo-Sci obtained a license to the material from Missouri S&T, named the borate glass material "DermaFuse," and approached PCRMC about starting the small-scale human test.

PCRMC approved the trial in July 2010, and nurse Taylor saw her first patient one month later. Once the study was underway, the company provided Taylor with individual, foil-sealed packets containing pads made of the glass fibers. She says the material is easy to apply. "You can form it, pick it, make it into any kind of shape you need out of it. I used tweezers to pack the material up into all of the recesses before filling the rest of the wound. I didn't pack it hard, but enough to fill all the crevices. Once it was in place, I covered it with a secondary covering or compression wrap."

One thing that surprised Taylor was that the glass fibers seem to disappear over time, a phenomenon that has been observed with other bioglasses. "Does it dissolve? Does it become part of the tissue? We don't quite know, but it is just such a neat thing to watch that process," she marvels.

Taylor acknowledges that under her care, the wounds would have probably healed without the glass material, but they would have required expensive vacuum-assisted healing systems that must be carried by patient at all times.

Besides low cost and ease of use, Taylor says the glass fibers seem to offer another stunning benefit: low scarring. "All but one of the patients in the trial were elderly and had a lot of skin discoloration, but we healed wounds that show nothing or negligible scarring," she reports.

Jung, who now works as a senior researcher for Mo-Sci, says that the next step is expanded human trials, which will be conducted in partnership with the Center for Wound Healing and Tissue Regeneration at the University of Illinois at Chicago. He says the center has agreed to begin testing the material this summer.

In the meantime, Jung says he and Day are optimistic about a new era in wound treatment. "We are really hoping the properties of these fibers can help with more extensive wounds, such as burns, and we easily foresee the day when soldiers or EMT workers carry packets of these glass fibers to provide healing protective covers that don't have to be removed."

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The story, "Cotton candy that heals? Borate glass fibers look promising" is available online at http://americanceramicsociety.org/bulletin/2011_pdf_files/may_11/#/27/

Video interviews with Peggy Taylor and Steve Jung are available online at: http://tinyurl.com/5vlsek3

Editor's note: For high- and low-resolution photographs and captions of the borate glass fiber materials, time-sequence wound healing and TEM comparisons with natural fibrin are available, please contact Peter Wray.

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