

'Shape-Memory' Materials May Soon Aid Orthopedic Surgery

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A sample of shape-memory alloy is mounted in a machine that tests the material by applying heat and pressure. Credit: Georgia Tech Photo by Gary Meek

An early stage medical-materials company based at the Georgia Institute of Technology is developing devices that may soon improve the treatment of human orthopedic conditions.

MedShape Solutions Inc.'s research focuses on “shape-memory” polymers and alloys -- solid materials that can change shape on demand. Company leaders say these materials’ ability to mold actively to human bone and tissue will make them useful in several types of reconstructive surgery.

MedShape’s shape-memory approach -- which is patent-pending and expected to go into human trials soon -- derives from the work of Ken Gall, a Georgia Tech associate professor. Gall and several other scientists have been developing these materials at Georgia Tech and the University of Colorado for several years.

“Most of the materials used in medicine are inactive, such as titanium, stainless steel, polyurethane, and acrylic -- they cannot respond to anything,” said Gall, who has appointments in both the School of Materials Science and Engineering and the School of Mechanical Engineering. “By contrast, our materials are mechanically active -- they respond to the human body by changing shape.”

One MedShape product application, called ShapeLoc™, has been designed for use in knee surgery. Currently, Gall explains, surgeons drill tunnels in bone and then anchor tendons into those tunnels with plastic or metal screw threads that often intrude into and injure tissue. By contrast, ShapeLocs’ shape-memory polymer fits into a surgical tunnel along with the tendon, conforming around the delicate tendon to hold it in place.

“This approach provides an easier surgical approach and stronger initial fixation, as well as better bone-tendon healing,” explains MedShape president and CEO Kurt Jacobus, who has a mechanical engineering science doctorate as well as five years of management-consulting experience with McKinsey & Co.

MedShape expects to soon market another product application called the

DynaNail™ system, a shape-memory alloy designed to help patients with diabetes and other conditions who suffer from soft-tissue damage in their lower extremities, resulting in debilitating ankle pain.

Currently, doctors address this tissue-damage problem with a procedure called ankle fusion, Gall said. This approach has a fairly low success rate because titanium and stainless-steel surgical nails often fail to maintain compression during the healing process. The DynaNail device employs “pseudo elastic” properties that allow it to achieve compression until bone fusion and healing can take place, avoiding the need for additional surgery or possible amputation.

MedShape has several other follow-on devices in the pipeline, Jacobus said. He expects these product applications to be useful in several areas of orthopedic surgery.

The work underlying MedShape’s current product applications began about 10 years ago at the University of Colorado, where Gall began his academic career. The basic research, performed by Gall and others, received about \$4 million in funding from the National Institutes of Health and the National Science Foundation over a number of years, as well as about \$1 million in private-placement funding.

Gall moved to Georgia Tech in 2005, and MedShape has received significant State of Georgia support since then. VentureLab -- a unit of Georgia Tech Commercialization Services that aids fledgling companies based on faculty discoveries -- helped the company win \$125,000 in Georgia Research Alliance commercialization grants. Moreover, in recent months Medshape has moved into on-campus research and office space.

“MedShape stood out above many other startup projects,” said Greg Dane, a Commercialization Services technology-evaluation manager who

advises the company. “The first reason is the technology itself, which has received major funding for years and has a strong patent position. Second, the management is quite strong – you don’t often find someone like Kurt Jacobus, who has a Ph.D.-level background in the science itself as well as extensive management experience.”

The company’s founders include several staff scientists, including Reed Bartz, M.D., a specialist in orthopedic surgery and team physician for the University of Nebraska; Douglas Pacaccio, D.P.M., a specialist in foot and ankle reconstruction, and Chris Yakacki, M.S., a doctoral candidate and shape-memory materials scientist.

MedShape’s leaders are currently weighing several options for funding their initial products’ path to the market, which will include further product development, U.S. Food & Drug Administration clearance, human trials and manufacturing. At this time, they say, they have not decided between a round of venture-capital funding or a strategic partnership with a large company or consortium.

“No matter which path we take, we’re still going to bring the same products to market,” Jacobus said. “We now have seven full-time employees, and we expect to have a product to market in two years.

Source: Georgia Institute of Technology

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