# Research aims to improve hip and knee replacement success

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Washington State University researchers are working to improve materials used in hip and knee replacements so that they last longer and allow patients to quickly get back on their feet after surgery.

Led by Susmita Bose, professor in the School of Mechanical and Materials Engineering, the researchers have received a five-year, $1.8 million National Institutes of Health grant to improve the way bone implants integrate into the body.

## Better bone-like material the goal

Every year, approximately 1 million hip and knee replacement procedures are done in the U.S. State-of-the-art titanium replacements are generally affixed using acrylic bone cement. Patients are often out of bed and walking within a day or two of surgery.

But the materials used are foreign to the human body and don't bond strongly to surrounding tissues, resulting in typical implant failure within 10-15 years. This becomes problematic for younger patients or those who need revision surgeries.

Coatings for titanium implants create a natural-feeling surface so surrounding tissue can better bond to it. But the bone-like materials used for coatings are weaker than natural bone, so recovery from surgery takes a long time. Patients wait weeks to walk, rather than days.

With the new grant, researchers aim to improve the bone-like material that is used as a coating, so the titanium-based implants will attach better to surrounding tissue, act more naturally within the body and last longer.

## Minerals, medications added to coatings

The researchers will mix ions commonly found in the body - such as magnesium, zinc and calcium - into their coatings. They also will add tiny amounts of medicine, such as antibiotics or osteoporosis medications, to the coatings.

They already have received patents on their innovative method of delivering medicine to a patient, which could be used like a time-release drug to fight infection or to build bone strength.

"This work could have a profound effect for younger patients and for those who undergo revision surgeries where bone volume is compromised," said Bose.

"A few extra years for these hip or knee replacements can make a tremendous difference," said research team member Amit Bandyopadhyay, also of WSU's School of Mechanical and Materials Engineering.

## Expanding on nanomaterials research

Bandyopadhyay and Bose have been leaders for more than a decade in 3D printing of bone materials and improved materials for bone implants. In preliminary studies, they have used nanomaterials to make coatings that are stronger and more biocompatible than those currently available. The grant will allow them to further test the new coatings. Others on the team are William Dernell of the WSU College of Veterinary Medicine,

physicians from Stanford University and the University of Washington medical schools, and graduate and undergraduate students from a variety of disciplines

Provided by Washington State University