Method and Material to Extend the Life of Total Joint Replacements through Wear Particle Activation (06-026)

Nanoparticles generated by normal wear are adapted to prolong implant lifespan

Market Overview

More than 500,000 joint replacements occur in the US each year and demand for joint replacements will grow an estimated 175 percent for total hip replacements and six-fold for total knee replacements by 2030 (CDC report “Health United States 2009”). These replacements typically last about 10 years or more, but as the patients live longer and are more active, demand for longer-lasting, more durable implants is greatly desired. A leading cause for joint replacement failure and subsequent need for revision surgery is osteolysis around the prosthetic implant. This condition is often caused by sub-micron wear particles from the ultra-high molecular weight polyethylene (UHMWPE); a material commonly used as a replacement bearing surface. This is a very well-known problem and although great strides to minimize wear particle generation have long been sought, the elimination of sub-micron wear particles is very unlikely. Clemson University researchers have developed a new approach to extending the life of orthopedic prosthesis implants through the release of therapeutic additives during the wear process.

Technical Summary

Bisphosphonates (BP) can be administered orally to prevent wear-debris induced bone loss at the joint replacement site, however this systemic delivery is highly inefficient in that most of the drug never reaches the target and is excreted via the kidney. This novel technology includes a method of utilizing the inevitable sub-micron wear particles as a means to locally administer bisphosphonates (BP)

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Application

Biomaterial for total joint replacement; orthopedic implant bearing material

Development Stage

Functional prototypes and materials

Advantages

- Increased longevity of joint replacement, reducing revision rates and increasing patient satisfaction
- Compatible with the most common orthopedic bearing materials, making the approach adaptable to current industry trends

at the targeted site over an extended period of time. This approach capitalizes on an issue, turning it into an advantageous feature that prolongs the life of the product. Completed studies at Clemson University indicate that the modified UHMWPE material shows significant potential for an alternative bearing material to indirectly increase total joint replacement longevity.

App Type	Country	Serial No.	Patent No.	CURF Ref. No.	Inventors
Utility	United States	13/360,020	8,858,979	06-026	Dr. John DesJardins, Martine Laberge, Cassandra Wright-Walker

About the Inventors

Dr. John DesJardins

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Dr. DesJardins earned his Ph.D. in Bioengineering from Clemson University and possesses over 20 years of experience as a biomechanical research engineer. He currently serves as the director of the Laboratory of Orthopedic Design and Engineering at Clemson University as well as the Frank H. Stelling and C. Dayton Riddle Orthopaedic Education and Research Laboratory at CUBEInC. Dr. DesJardins holds two issued patents and several U.S. and foreign applications. His research interests focus on total joint replacement, orthopaedic biomechanics, and biomaterials.

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