An Orthopedic Implant Coating for Enhanced Bone Growth

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a biologically active coating for orthopedic implants to enhance bone regeneration.

OVERVIEW

"Orthobiologics" provides an improved method of treating fractures and other bone defects. This therapy employs inductive molecules, such as bone morphogenetic protein-2 or bone morphogenetic protein-4, to stimulate natural bone growth in defects. The proteins are embedded or adsorbed within collagen sponges, porous ceramic blocks or synthetic polymers and then delivered to the defects.

However, clinical use of orthobiologics technology has been problematic. Carrier materials currently used, such as collagen sponges, to deliver bone growth factors have been inappropriate for orthopedic applications, due at least in part to poor bulk mechanical and degradation properties. Diffusion of growth factors from such carrier materials is not controllable and is released too quickly, leading to rapid degradation in vivo. And new tissue regeneration approaches are not designed to integrate with existing surgical procedures. Improved platforms for delivering inductive molecules in a targeted and controlled fashion are needed before orthobiologics can be widely utilized.

THE INVENTION

UW-Madison researchers have developed a biomaterial-based approach for directing bone regeneration to treat bony defects. This approach uses a biologically active calcium phosphate-based coating to target and control delivery of a bound growth factor molecule capable of inducing bone growth. This coating can be applied to all bioresorbable materials commonly used in orthopedic surgery, including nails, pins, anchors, screws, plates and scaffolds.

Under physiological conditions, the solubility of different calcium phosphate materials can vary by more than 5000 percent. To take advantage of this broad range of dissolution rates, the coating consists of several layers of calcium phosphate materials with distinct dissolution profiles. Bone growth factors are bound to the calcium phosphate and released based on the dissolution profile of each layer. To provide a delayed release,
calcium phosphate layers that do not contain a growth factor or drug can be incorporated into the coating. This approach can be easily integrated with existing implants and surgical procedures in clinics.

**BUSINESS OPPORTUNITY**

- Regeneration of natural skeletal tissue represents a promising new approach to expand the current range of conditions that can be treated effectively.
- The medical costs of treating musculoskeletal conditions represent an average of 3% of the gross domestic product of developed countries.
- In the U.S. this annual cost is estimated at $254 billion.
- The U.S. market segment for orthopedic implants is approximately $100 million and growing.
- More than 239,000 knee cruciate ligament reconstructions are performed annually at a total cost of $3.5 billion.
- A Frost and Sullivan report identifies bioresorbable materials as a key trend that could permanently solve the inherent problems associated with metal implants.
- Revenues for bone growth therapeutic products are expected to grow by more than 40% per year for the foreseeable future.

**APPLICATIONS**

- Bioresorbable scaffolds, including arrows, barbs, tacks, bone anchors and other anchors, nails, pins, interference screws and other screws, staples and plates, for the treatment of skeletal defects

**KEY BENEFITS**

- Enhances bone growth
- Provides a customizable coating for controlling drug delivery
- Materials are readily available.
- Growth factor is protected from degradation until it is released from the biodegradable coating, resulting in coatings that can last from 12 hours to several months.
- Integrates with existing implants and surgical procedures

**ADDITIONAL INFORMATION**

**Tech Fields**

- Medical Devices - Device coatings
- Medical Devices - Orthopedics
- Materials & Chemicals - Polymers

**CONTACT INFORMATION**

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