An Orthopedic Implant Coating for Enhanced Bone Growth

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Technology description

Description

"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.
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.
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.

Application area

This coating can be applied to all bioresorbable materials commonly used in orthopedic surgery, including nails, pins, anchors, screws, plates and scaffolds.

Advantages

This approach can be easily integrated with existing implants and surgical procedures in clinics.

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